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Scientific and Technical Aerospace Reports

A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

MARCH 8, 1970

VOLUME 8 • NUMBER 5

N70-15505—N70-16904

DOCUMENTS DEPT.

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Scientific and Technical Aerospace Reports, Volume 8, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget June 7, 1966.

INTRODUCTION

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **782**

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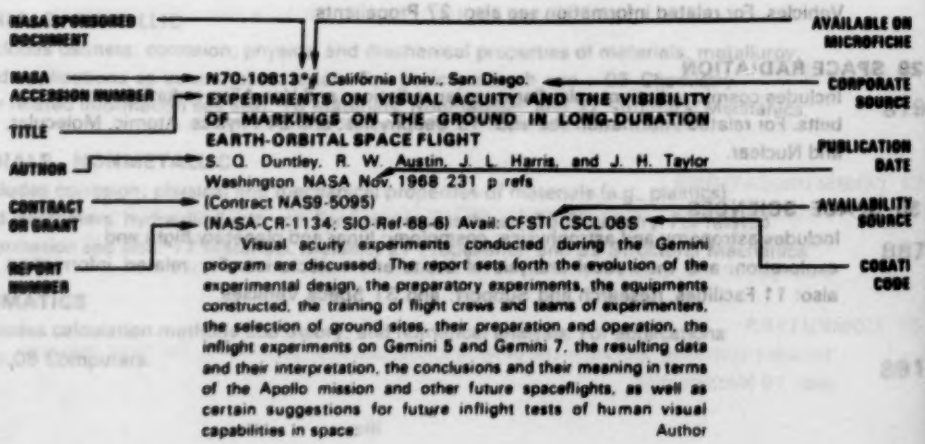
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PUBLICATION DATE
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
Washington NASA Nov. 1968 231 p refs
CONTRACT OR GRANT
(Contract NAS9-5095)
AVAILABILITY SOURCE
REPORT NUMBER
(NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

VOLUME 8 NUMBER 5 / MARCH 8, 1970

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A Semimonthly Publication of the National Aeronautics and Space Administration

SPECIAL NOTICE

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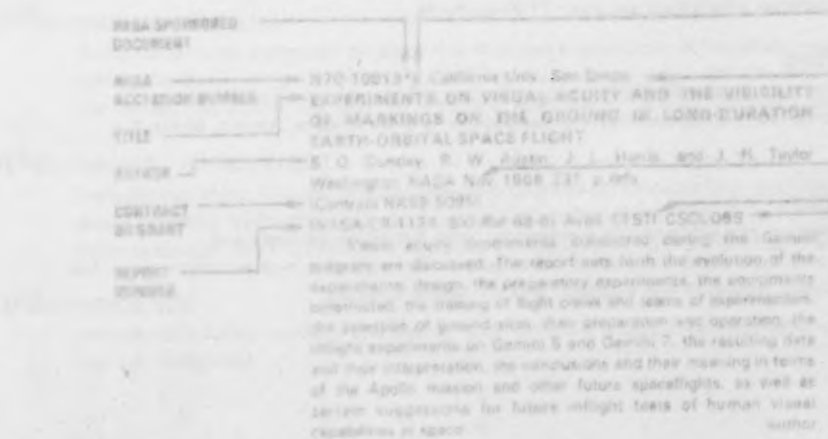
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ABSTRACT
EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
E. D. Gurley, R. W. Austin, J. L. Hinds, and J. R. Taylor
Washington NASA Nov 1968 137 p refs
(Contract NASS-5091)
(NASA-CR-91134 SID-Rpt-68-61) Avail: CFSTI CSCL 06B
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experiments design, the preparatory experiments, the accompanying instrumentation, the training of flight crews and teams of supervisors, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
author

VOLUME 8 NUMBER 5 / MARCH 8, 1970

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A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-15806*# Kaman Aircraft Corp., Bloomfield, Conn.
THE DYNAMIC BEHAVIOR OF ROTOR ENTRY VEHICLE CONFIGURATIONS. VOLUME 2: DIGITAL COMPUTER PROGRAM MANUAL
N. Giansante and R. F. Metzger Jan. 1969 235 p refs
(Contract NAS2-3917)
(NASA-CR-73391; R-767-2) Avail: CFSTI CSCL 01A

The digital computer program developed to evaluate the aerodynamic and performance characteristics and dynamic behavior of a rotor in autorotative flight operating in proximity of a re-entry capsule is described. The theory underlying the program formulation is presented. The program has been subdivided into distinct parts: (1) calculation of rotor blade linear dynamic response in the flapping, feathering and lagging modes; and (2) determination of rotor blade airloads including nonlinear effects. The equations of motion describing the articulated rotor blades retain all nonlinear inertial terms and incorporate nonlinear aerodynamics to account for stall, compressibility and reversed flow effects. Provisions are included to consider the effects on the rotor of the detached bow shock wave generated by the capsule. The program also features the dynamic stability of the reentry vehicle. The nonlinear time history of the capsule rotor configuration features rotor force and moment contributions which are a function of the independent variable time. Author

N70-15576# Polytechnic Inst. of Brooklyn, N.Y.
RESEARCH OF AERODYNAMIC PHYSICS INSTITUTE FOR PROJECT STRATEGIC TECHNOLOGY Semiannual Technical Summary for Period Ending 31 Mar. 1969
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The Polytechnic Institute of Brooklyn is conducting a broad interdisciplinary theoretical and experimental research program in aerodynamics and related physics pertinent to plasmas, diagnostics, electromagnetic scattering and turbulence, applicable to the current and long-range interests of the ARPA Strategic Technology Office. Emphasis is placed on subjects characteristic of ballistic missile defense situations. This report contains a compilation of abstracts of papers which were either accepted for publication or were published. The papers are on the subjects of fluid dynamics, electromagnetics and plasmas. This summary also contains a listing of papers submitted to journals, lectures, internal reports and staff activities. Author (TAB)

N70-15890# National Physical Lab., Teddington (England). Aerodynamics Div.
DEVICES FOR REDUCING THE FLUID-DYNAMIC TORQUE ON BUTTERFLY-VALVE DISCS
D. W. Bryer and D. E. Walshe May 1969 44 p refs Supersedes (NPL-AERO-1201)
(NPL-AERO-1298; NPL-AERO-1201) Copyright. Avail: CFSTI

Measurements have been made of the aerodynamic torque on butterfly-valve discs fitted with fences, on cambered discs, and on cambered discs with fences; flow rates in the duct were measured simultaneously. Results for discs mounted on diametrical or on inclined spindles, when compared with those for discs of conventional shape, show that for a constant pressure drop across the valve, the use of fences, camber, or a combination of both will achieve a reduction of torque; an accompanying loss in maximum flow rate is small and is least with the cambered discs. Author (ESRO)

N70-16027# National Physical Lab., Teddington (England). Aerodynamics Div.
REVIEW OF ROYAL AERONAUTICAL SOCIETY AERODYNAMICS DATA SHEETS IN THE LIGHT OF RECENT IMPROVEMENTS IN SUBSONIC LIFTING-SURFACE THEORY
H. C. Garner Mar. 1969 17 p refs Prepared jointly with Aeron. Res. Council
(NPL-AERO-NOTE-1079; ARC-31062) Copyright. Avail: CFSTI

Eight data sheets on wings with incremental incidence and three on deflected control surfaces are reviewed. The ten planforms, for which theoretical data on lift slope and aerodynamic center are considered, cover wide ranges of aspect ratio, taper ratio, sweepback; three incorporate control surfaces with calculated lift and hinge moment. Two data sheets are unsatisfactory; the others only need minor revision or extension to higher sweepback. Author (ESRO)

N70-16101# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.
PROBLEMS OF THERMAL GROUND EFFECT [PROBLEME DES THERMISCHEN BODENEFFEKTS]
Heinrich Dissen and Eckart Schwantes Jun. 1969 72 p refs In GERMAN; ENGLISH summary Proc. of the DFVLR Meeting on Jet Deflection, Brunswick, 27 - 28 Feb. 1969
(DLR-Mitt-69-14) Avail: CFSTI

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8. INVESTIGATIONS OF STATIC PRESSURE PROBES AT HIGH SUBSONIC VELOCITIES H.-J. Roscher p 70–74 refs (See N70-16109 05-01)

N70-16102# Aerodynamische Versuchsanstalt, Gottingen (West Germany).

JET INVESTIGATIONS OF THE AERODYNAMISCHE VERSUCHSANSTALT GOETTINGEN [STRAHLUNTERSUCHUNGEN DER AERODYNAMISCHEN VERSUCHSANSTALT GOETTINGEN]

Fritz-Reinhard Grosche *In* DFVLR Probl. of Thermal Ground Effect Jun. 1969 p 18–21 refs In GERMAN (See N70-16101 05-01)

Avail: CFSTI

Research projects concerning the flow fields of cold and heated free jets, the jet interference around various bodies, and the noise generation by turbulent jets and noise reduction are discussed. The experimental equipment is briefly described. ESRO

N70-16103# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.

RESULTS OF THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE THERMAL GROUND EFFECT AT THE INSTITUT FUER STRAHLANTRIEBE OF THE DFL [ERGEBNISSE DER THEORETISCHEN UND PRAKTISCHEN UNTERSUCHUNGEN UEBER DEN THERMISCHEN BODENEFFEKT IN INSTITUT FUER STRAHLANTRIEBE DER DFL]

Eckart Schwantes *In its* Probl. of Thermal Ground Effect Jun. 1969 p 22–28 refs In GERMAN (See N70-16101 05-01)

Avail: CFSTI

The results obtained from experiments with a ground effect test station are described, the engine model providing for inlet ejector suction and hot air ejection in any direction. The wall jet velocity and temperature profiles are measured by means of a movable frame carrying pitot tubes and thermoelements and the recirculation is made visible by means of light sheets and a contrast powder. ESRO

N70-16107# Vereingte Flugtechnische Werke G.m.b.H., Bremen (West Germany).

INVESTIGATIONS OF THE THERMAL GROUND EFFECT CONDUCTED BY THE VEREINIGTE FLUGTECHNISCHE WERKE [VON DEN VEREINIGTEN FLUGTECHNISCHEN WERKEN DURCHGEFUEHRTE UNTERSUCHUNGEN DE THERMISCHEN BODENEFFEKTS]

Reinhard Behnert *In* DFVLR Probl. of Thermal Ground Effect Jun. 1969 p 51–59 refs In GERMAN (See N70-16101 05-01)

Avail: CFSTI

An improvement in measuring techniques for ground effect investigations with scale models, using hot compressed air jets is reported. A systematic definition of the inlet temperature and the impulse adjustment is established. It was found that inlet temperatures fluctuate even at constant exhaust temperatures, and this effect is ascribed to upwash and vortex phenomena. ESRO

N70-16108# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

ON THE CALCULATION OF THE TURBULENT PROPAGATION OF FREE JETS [UEBER DIE BERECHNUNG DER TURBULENTEN AUSBREITUNG VON FREISTRAHLEN]

Edgar Juenke *In* DFVLR Probl. of Thermal Ground Effect Jun. 1969 p 60–69 refs In GERMAN (See N70-16101 05-01)

Avail: CFSTI

In this survey on the theoretical treatment of free jet mixing flow by various authors it is noted that the constants entering the equations are not of an universal nature, but must be determined experimentally for every case. This difficulty arises from the influence of the initial and boundary conditions. ESRO

N70-16109# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. Fuer Strahlantriebe.

INVESTIGATIONS OF STATIC PRESSURE PROBES AT HIGH SUBSONIC VELOCITIES [UNTERSUCHUNGEN AN STATISCHEN DRUCKMESSSONDEN FUER HOHE UNTERSCHALLGESCHWINDIGKEITEN]

Hans-Joachim Roscher *In its* Probl. of Thermal Ground Effect Jun. 1969 p 70–74 refs In GERMAN (See N70-16101 05-01)

Avail: CFSTI

A comparison for accuracy and calibration was made between cylindrical tube pressure sensors and hook sensors but the pressure measurements were limited to high subsonic flow velocities. ESRO

N70-16124# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

TESTS AT M = 1.82 ON AN ENGINE INSTALLATION WITH BOUNDARY-LAYER DIVERTER FOR A SLENDER GOTHIC WING

R. T. Griffiths London HMSO 1969 30 p refs Supersedes RAE-TR-67203; ARC-30107

(ARC-CP-1050; RAE-TR-67203; ARC-30107) Avail: CFSTI

A previous report (ARC-CP-866; see N67-29894) described tests made at M = 1.82 on an engine installation representing a design in which four engines were mounted side by side in each of two nacelles, one on each half of a slender gothic wing, with the engines partly buried in the wing. The present paper gives comparative results for an installation incorporating a boundary layer diverter; this led to 2 × 2 square array of engines in each nacelle, with intakes having vertical wedge compression surface. In this case the nacelles were as short as possible and no attempt was made at partial burying in the wing. With the particular design of boundary layer diverter used, and because of the short nacelles, the nacelle drag was high and the intake pressure recovery was lower than expected. There were small and predictable effects on lift and pitching moment. Author (ESRO)

N70-16198# Messerschmitt-Boelkow G.m.b.H., Munich (West Germany). Entwicklungsring Nord, Bremen (West Germany).
INVISCID IDEAL GAS FLOW AROUND THE ELDO-A VEHICLE FOR FREE STREAM MACH NUMBERS 1.8 TO 10
P. Mittelbach Arbeitsgemeinschaft Satellitentraegersystem 18 Dec. 1968 170 p Prepared for ELDO
(Contract ELDO-CTR/17/4/14)
Avail: CFSTI

This report provides all necessary data on the inviscid ideal gas flow around the ELDO-A launch vehicle for free-stream Mach numbers from 1.8 to 10 for further kinetic heating calculations. ESRO

N70-16346# National Physical Lab., Teddington (England). Aerodynamics Div.
INFLUENCE OF WING ROOT SHAPING ON THE PRESSURE DISTRIBUTION OF SWEPT-WING BODY CONFIGURATIONS
J. Bridgewater and K. H. Wilson 1 Jul. 1969 15 p refs Prepared jointly with Aeron. Res. Council
(NPL-AERO-NOTE-1082; ARC-31311) Copyright. Avail: CFSTI

Swept wing pressure fields calculated by inviscid linearized theory are presented for symmetric wing-body configurations at Mach number = 1.414. The effects of varying the inboard wing shape are investigated, with the aim of minimizing the associated body waisting needed to achieve a desirable isobar pattern, and to produce a good overall area distribution. Author (ESRO)

N70-16348# National Physical Lab., Teddington (England). Aerodynamics Div.
THE DRAG OF A CIRCULAR CYLINDER FITTED WITH SHROUDS
B. J. Knell May 1969 15 p refs
(NPL-AERO-1237) Copyright. Avail: CFSTI

The effect on the drag of fitting shrouds on cylinders of infinite aspect-ratio and free-ended stacks has been investigated. The Reynolds number range was 8.10,000 to 3.1,000,000. The shrouds had square holes and were of 36% and 20% open area ratio. It is found that as far as the effect on the drag of the cylinder was concerned, these two configurations were indistinguishable. The drag coefficient for a shrouded cylinder was about 0.9 based on the cylinder diameter, and showed very little dependence on Reynolds number. Author (ESRO)

N70-16352# National Physical Lab., Teddington (England). Aerodynamics Div.
THE CORRELATION AND PREDICTION OF PRESSURE DISTRIBUTIONS ON COMPRESSION SURFACES OF SHARP-EDGED CONICAL BODIES AT HIGH SUPERSONIC SPEEDS
M. J. Larcombe London HMSO 1969 13 p refs Supersedes NPL-AERO-1261; ARC-30287; See N69-19756
(ARC-CP-1072; NPL-AERO-1261; ARC-30287) Avail: CFSTI

A method for caclulating the pressure distributions around conical bodies at high supersonic speeds, based on a local cone-flow theory, has been developed from the successful correlation of pressures at a symmetrical ridge line. The method is shown to provide a means for the accurate estimation of pressures on compression surfaces of conical bodies with sharp leading edges, providing the shock wave is detached from the edge. Authr (ESRO)

N70-16353# Queen Mary Coll., London (England).
A SEMI-EMPIRICAL THEORY FOR THE GROWTH AND BURSTING OF LAMINAR SEPARATION BUBBLES
H. P. Horton London HMSO 1969 39 p Sponsored by Min. of Aviation refs Supersedes ARC-29185
(ARC-CP-1073; ARC-29185) Copyright. Avail: HMSO 9s; BIS $1.80; CFSTI

A simple pressure gradient criterion for the determination of the conditions under which re-attachment of a turbulent shear layer can occur is proposed. Application of this criterion to the laminar separation bubble problem together with a simple bubble model and an approximate method of calculation of the momentum thickness growth over the bubble, leads to a method of prediction of the bubble growth. It is found that for a given imposed pressure distribution there exists a Reynolds number at separation below which re-attachment is impossible; this is associated with the so-called 'bursting' phenomenon. The predicted bursting parameters are in good agreement with experimental observations; in particular, the value of Crabtree's pressure rise parameter is found to be weakly dependent upon the boundary-layer Reynolds number at separation, varying between the limits 0.27 to 0.36 over the range of practical significance. It is concluded that bursting occurs as a failure of the re-attachment process, as suggested by Woodward. Author (ESRO)

N70-16354# National Physical Lab., Teddington (England). Aerodynamics Div.
CONDITIONS FOR THE EXISTENCE OF AN INERTIAL SUBRANGE IN TURBULENT FLOW
P. Bradshaw London HMSO 1969 7 p refs Supersedes NPL-AERO-1220; ARC-28664
(ARC-R/M-3603; NPL-AERO-1220; ARC-28664) Avail: CFSTI

It is found experimentally that the value of K(1) in the spectrum formula about 100, both in homogeneous turbulence and in shear flow; this value of Re is much less than that usually predicted. The result can be used to derive dissipation from medium-frequency spectra at moderate laboratory Reynolds numbers. Author (ESRO)

N70-16361# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
FREE FLIGHT MODEL MEASUREMENTS OF THE LONGITUDINAL STABILITY OF A TRANSONIC SWEPT-WINGED AIRCRAFT
G. K. Hunt London HMSO 1969 58 p refs Supersedes RAE-TR-68178; ARC-31021
(ARC-CP-1052; RAE-TR-68178; ARC-31021) Avail: CFSTI

Four models of an aircraft configuration with a 55 degree swept wing were flown at Mach numbers between 0.9 and 1.4, at Reynolds numbers up to 10 million and lift coefficients between zero and 0.5. Measurements of the manoeuvre margin and the derivatives were obtained. The results are compared with those obtained from one of the same models in a trasonic wind tunnel and from a related M-wing model in flight. They are also corrected for aeroelastic effects. Author (ESRO)

N70-16364# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
WIND TUNNEL TESTS ON MODEL OF ELDO SLV EUROPA 3 WITH TWO BLUE STREAK BOOSTERS AT MACH NUMBERS FROM 0.8 TO 1.9
C. H. Rip and S. J. Boersen 25 Jun. 1969 157 p refs Sponsored by ELDO
(NLR-TR-69052-V) Avail: CFSTI

Force and moment measurements were carried out on a 1/50th smooth model of the ELDO SLV Europa 3 with two Blue Streak boosters in the NLR wind tunnels HST and SST. The test program included simultaneous measurements on the complete vehicle as well as one booster, at Mach numbers from 0.8 to 1.9, to establish the basic aerodynamic coefficients. The angle of incidence was varied between −6 and +8 deg for all Mach numbers tested. The Reynolds numbers based on the core vehicle diameter were approximately 0.8 × 100,000 for the HST and 1.4 × 100,000 for the SST tests. Results show a marked difference between the two symmetric cases of boosters in pitch plane and boosters in yaw plane; the CN/alpha slope of the latter is four times the value of the former at Mach number 1.8. There is a marked

effect of booster orientation, not only on the overall coefficients, but also on those of the booster. The effect of booster/core clearance variation, however, is relatively small. Author (ESRO)

N70-16745*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERONAUTICAL CHARACTERISTICS OF AN OBLATE SPHEROID AND A SPHERE AT MACH NUMBERS FROM 1.70 TO 10.49
Lloyd S. Jernell Washington Jan. 1970 25 p refs
(NASA-TN-D-5600; L-6750) Avail: CFSTI CSCL 01A

A wind-tunnel investigation was conducted to determine the stability and drag characteristics of an oblate spheroid at angles of attack from approximately −4 deg to 12 deg. Drag coefficients on spheres were obtained for comparison. The results are compared with modified Newtonian theory and several empirical expressions. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-15543*# Techtran Corp., Glen Burnie, Md.
DETERMINATION OF AIRCRAFT AND ENGINE PARAMETERS WHICH ENSURE A MAXIMUM THEORETICAL RANGE FOR A GIVEN CRUISING SPEED [OPREDELENIE PARAMETROV SAMOLETA I DVIGATELYA OBESPECHIVAYUSHIKH MAKSIMAL'NUYU TEORETICHESKUYYU DAL'NOST' PRI ZADANNOI KREISERSKOI SKOROSTI POLETA]
I. F. Florov and O. K. Lugov Washington NASA Jan. 1970 11 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy, Aviats. Tekhn. (USSR), v. 11, no. 3, 1968 p 16 – 22
(Contract NASw-1695)
(NASA-TT-F-12732) Avail: CFSTI CSCL 01C

Discussion of two versions of the problem of determining the maximum theoretical range of a turbojet for a given cruising speed. The first problem is to determine the maximum theoretical range without any additional requirements placed on the aircraft by the takeoff portion of the flight. The second problem is to determine the maximum theoretical range at a given takeoff distance. Equations are derived for calculating aircraft and engine parameters which ensure a maximum theoretical range. The equations are seen to be useful in the preliminary design of turbojet aircraft. Author

N70-15896# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
EFFECT OF GROUND CRASH FIRE ON AIRCRAFT FUSELAGE INTEGRITY Interim Report
George B. Geyer Dec. 1969 74 p refs
(NA-69-37; RD-69-46) Avail: CFSTI

A mathematical model was formulated which permits a calculation to be made of the time required for damage to occur to the aluminum skin covering an aircraft fuselage when it is exposed to maximum spill fire conditions. The damage time was defined as the time required for the aluminum skin to melt. The model was developed through consideration of the heat transfer rates by convection and radiation across a simplified aircraft fuselage configuration. The resulting differential equation was solved using a numerical technique. The results indicate that the minimum time required for skin damage to occur to the largest commercial aircraft now in service is less than 40 seconds. The fuselage damage time predictions, made through the use of the mathematical model, correspond closely with measurements made on simulated aircraft skin configurations employing a 40 foot, stainless steel covered section of a four engine jet aircraft fuselage. Author

N70-15640*# Raven Industries, Inc., Sioux Falls, S. Dak. Engineering Systems Div.
BALLOON STRAIN RELIEF SYSTEM
Sep. 1969 46 p refs Prepared for Natl. Center for Atmospheric Res.
(Contract NASr-185)
(NASA-CR-107690; PB-186245; NCAR-TN-44) Avail: CFSTI CSCL 01C

A balloon strain relief system for use during prelaunch activities was developed and its effect on balloon tensile strength was examined. The system consists of inflatable clamps which surround a portion of the balloon below the inflated bubble and thus relieve the strain on the lower portion of the balloon. Various clamp materials and balloons and tensile test specimens from the balloons were laboratory tested. Author (USGRDR)

N70-15651*# Techtran Corp., Glen Burnie, Md.
BUFFETING TESTS [ESSAIS DE TREMBLEMENT]
Francois Charpin Washington NASA Jan. 1970 13 p refs Transl. into ENGLISH from French report
(Contract NASw-1695)
(NASA-TT-F-12776; TP-664) Avail: CFSTI CSCL 01C

The study of the amplitude of the symmetrical flexure oscillations of a wind tunnel model wing leads to the determination of the initiation of buffeting as a functioning of the angle of attack and of the Mach number. The analysis of the pressure coefficients at the trailing edge of this wing shows the evolution of the flow separations that originate the buffeting. This paper describes the experimental and data reduction methods used during the tests carried out in the transonic section of the O.N.E.R.A. S2 MA wind tunnel at Modane. The results obtained, in the 0.3 – 0.9 Mach number range on a 1/14 scale model of the Breguet 1001 TAON aircraft, are analyzed and compared with other results obtained in wind tunnel and in flight. Author

N70-15671# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
COCKPIT WARNING SYSTEMS COMPARATIVE STUDY
Almon J. Bate May 1969 47 p refs
(AD-695462; AMRL-TR-68-193) Avail: CFSTI CSCL 1/4

This study was conducted to determine the relative merits of supplementing aircraft visual/annunciator panel malfunction warning systems with a general alerting tone or with a voice recording identifying specific malfunctions. When a malfunction occurred, subjects pushed the one illuminated switch of sixteen malfunction indicators located on the annunciator panel. Subjects also performed a navigation task in which they momentarily positioned, under cross hairs, a series of navigational checkpoints displayed on rear-projected aerial strip photography. The photographic imagery moved across a 10-by-10-inch viewing screen at three simulated aircraft speeds: 340, 1160, and 2260 knots. One malfunction warning occurred during the last half of each test period. Although navigation performance (number of navigational checkpoints detected) decreased as simulated speed increased, this performance did not vary with the warning systems. The strictly visual annunciator panel malfunction warning system was the poorest system tested. The addition of a general alerting tone resulted in quicker and usually less variable responses at all aircraft speeds than did any of the other systems. Author (TAB)

N70-15695# Army Aeromedical Research Unit, Fort Rucker, Ala.
VISIBILITY FROM THE REAR SEAT OF THE US ARMY O-1A (BIRD DOG) AIRCRAFT
John K. Crosley and Robert W. Bailey Aug. 1969 33 p refs
(AD-693797; USAARL-70-3) Avail: CFSTI CSCL 1/3

The dynamic visual field of view was measured from the rear seat of the U. S. Army O-1A (Bird Dog) aircraft. Subjects from the 5 and 95 percentile level sitting eye heights were used to determine the changes in field of view when the short man occupied the front seat and the tall man the rear, and vice versa. Changes occurring as a result of using a cushion, sitting in a fixed position, or moving the extent of the seat harness were also measured. Recommendations are made concerning seat adjustment characteristics, rear window design, the availability of instruments to the Instructor Pilot in the rear seat, and the weather standards for dual VFR flight. Author (TAB)

N70-15722# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
STRUCTURAL DESIGN OF MAN POWERED AIRCRAFT
P. W. Sharman Jul. 1969 16 p
(TT-6911) Avail: CFSTI

As an example in structural design, a man powered aircraft was investigated. The aerodynamic shape was basically a low wing canard monoplane with a fin mounted pusher propeller. The empty weight was estimated from the structural configuration as 145 lb. A weight breakdown is given. Author

N70-15769# Royal Aircraft Establishment, Farnborough (England). Ministry of Technology.
APPLICATION OF THE ROOT-LOCUS METHOD TO AEROELASTICALLY COUPLED SYSTEMS [ANWENDUNG DES WURZELORTSKURVENVERFAHRENS AUF AEROELASTISCH GEKOPPELTE SYSTEME]
Peter Hamel (Technical Univ., Braunschweig) Jun. 1969 37 p refs Transl. into ENGLISH from Jahrbuch Der Wglr 1967 p 350–362 Presented at the Joint Ann. Meeting of the WGLR and DGRR, Karlsruhe, 3–6 Oct. 1967 /its Library Transl. No. 1389
Avail: CFSTI

The root-locus method was developed for stability analysis of feed-back control systems. It is the purpose of this paper to show how the root-locus method can be applied to stability investigations of aircraft with aeroelastic feedback. The singularities of the performance function of the equivalent open loop, which determine the character of the root-locus branches, describe in combination with the root-locus gain in the aeroelastic coupling involving rigid-body and elastic-body degrees of freedom. The root-locus method is applied to the longitudinal and lateral dynamics of a flight vehicle with flexible fuselage and wing. Singularities and the root-locus gain acquire simple physical meanings. Finally, the method is used for the stability analysis of a binary oscillatory wind-tunnel balance. Author

N70-15896# Naval Air Engineering Center, Philadelphia, Pa. Engineering Dept.
A GENERALIZED STUDY OF EA1F AIRCRAFT BRIDLE SHED MECHANISMS
M. Siegel 5 Jun. 1969 169 p
(AD-694934; NAEC-eng-7606) Avail: CFSTI CSCL 1/3

A study of bridle shedding phenomena is undertaken for the launching of the EA1F aircraft with steam catapult systems. A theoretical analysis is made of the basic mechanics of shedding phenomena, and the dynamics of the aircraft coupled to the catapult system in an effort to provide a base for interpreting several experimental studies underway. Various recommendations are given for improving the catapult system to reduce the probability of bridle shedding. Author (TAB)

N70-15971*# National Academy of Engineering, Washington, D.C. Aeronautics and Space Engineering Board.
CIVIL AVIATION RESEARCH AND DEVELOPMENT: AN ASSESSMENT OF FEDERAL GOVERNMENT INVOLVEMENT. FLIGHT VEHICLES AND AIRBREATHING PROPULSION
Dec. 1968 63 p refs
(Contract NSR-09-012-912)
(NASA-CR-107678) Avail: CFSTI CSCL 01C

The consolidated study by the committee on airbreathing flight vehicles is reported, including comments and recommendations relating to matters such as operating problems and support facilities. Major areas considered are: vehicle control, aerodynamics, mechanical structure, and V/STOL and helicopter system development, engine combustor research, compressor technology, and performance of propulsion systems. Comments on the role of government in civil aeronautical research and development are grouped as: (1) Applied research that exceeds the resources of private industry but serves as a stimulant. (2) Major development programs where private economic resources are inadequate. (3) Programs that are associated with public welfare. (4) Programs that require interaction between governmental agencies. F.O.S.

N70-15977# Naval Civil Engineering Lab., Port Hueneme, Calif.
SEA-ICE BEARING STRENGTH IN ANTARCTICA: AIRCRAFT LOAD CURVES FOR McMURDO ICE RUNWAY Technical Report, Jun. 1967 – Dec. 1968
J. E. Dykins and J. S. Hopkins Sep. 1969 41 p refs
(AD-694954; NCEL-TR-641) Avail: CFSTI CSCL 1/5

To update the operating criteria for C-121, C-124, C-130, C-141, and C-5 aircraft in the Antarctic, the bearing capacity of the McMurdo annual sea-ice sheet was analyzed for short-term loading. The load curves developed by elastic theory predict the ice thickness required as related to the changing strength characteristic of the ice sheet associated with the seasonal warming trend. These load curves provide operating criteria that are more related to the ice-sheet temperature than the operating criteria now in use. This analysis is only an interim solution in the development of aircraft operating criteria; continued research is needed to provide a better understanding of the ice-sheet response to both short- and long-term loads. The load curves and instructions presented in Appendix B are recommended to replace the present operating criteria appearing in NCEL Technical Note N-888, Interim Aircraft Load Curves for Sea-Ice Runways at McMurdo, Antarctica. Author (TAB)

N70-16104# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
RECIRCULATION STUDIES WITHIN THE DO-31 DEVELOPMENT [REZIRKULATIONSUNTERSUCHUNGEN IM RAHMEN DER DO 31-ENTWICKLUNG]
Peter Dick *In* DFVLR Probl. of Thermal Ground Effect Jun. 1969 p 29–38 In GERMAN (See N70-16101 05-01)
Avail: CFSTI

Results from scale model experiments and aircraft flight tests on vertical take-off and landing were reported. They were concerned with predicting the influence of jet angles, thrust ratio, and pitch on aircraft performance. Comparison experiments were also carried out on recirculation effects and upwash phenomena. Further projects with variable configuration scale models for investigating complex lift jet arrangements are described. ESRO

N70-16105# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
INVESTIGATIONS CONDUCTED TO DATE AT THE INSTITUT FUER ANGEWANDTE GASDYNAMIK OF THE DVL ON SECONDARY EFFECTS IN EXHAUST JETS OF

AIRCRAFT SCALE MODELS [BISHER IM INSTITUT FUER ANGEWANDTE GASDYNAMIK DER DVL DURCHEEFUEHRTE UNTERSUCHUNGEN UEBER SEKUNDAEREFFEKTE INFOLGE STRAHLAUSBLASUNG AN FLUGZEUGMODELLEN]

Guenter Viehweger *In its* Probl. of Thermal Ground Effect Jun. 1969 p 39–45 refs In GERMAN (See N70-16101 05-01)
Avail: CFSTI

Scale model experiments were conducted using cold compressed air to simulate jet blast effects in order to determine the primary and secondary aerodynamic forces on V/STOL aircraft near the ground. A lift reduction effect due to injector effects was found which is accompanied by changes in pitching moment. Further experiments are announced. ESRO

N70-16106# Entwicklungsring Sud, Munich (West Germany).

INVESTIGATIONS OF THERMAL GROUND EFFECT CONDUCTED BY THE ENTWICKLUNGSRING SUED [VOM ENTWICKLUNGSRING SUED DURCHGEFUEHRTE UNTERSUCHUNGEN DES THERMISCHEN BODENEFFEKTS]

Waldburg Eder *In* DFVLR Probl. of Thermal Ground Effect Jun. 1969 p 46–50 refs In GERMAN (See N70-16101 05-01)
Avail: CFSTI

Scale model recirculation experiments are reported at jet temperatures up to 1400 K at a Mach number of unity. Also, 1:2 scale experiments with operative jet engines were conducted. The results of these experiments are being evaluated to be able to predict recirculation effects. ESRO

N70-16135# Hamilton Standard, Windsor Locks, Conn.

AIRCRAFT PROPELLER VIBRATION MEASUREMENT SYSTEM Final Report

Richard C. Dorshimer Sep. 1969 136 p
(Contract FA-67-NF-257)
(AD-694009; FAA-NA-69-23; FAA-DS-69-5) Avail: CFSTI CSCL 01/3

A slip ringless propeller-mounted data system was designed, fabricated and tested for the measurement of propeller blade strain during flight and ground operation of an instrumented aircraft. This data system is self-powered through the rotary motion of the test propeller, employs a 16 channel constant bandwidth Frequency Modulated (FM) Multiplex and signals are capacitively coupled from the propeller to the aircraft. The fm Multiplex consists of 17 channels of information including propeller rpm and 16 strain gage channels containing information from dc to 1 kHz. An environmentally protected strain gage installation was also a consideration of this program. The fm Multiplex is split into four groups of signals with a frequency translation process in order to conserve bandwidth and/or recording time on an airborne tape recorder. Seven additional data channels are provided on board the aircraft for inclusion of parameters needed to define the aircraft operating conditions. The data system was demonstrated for a period of 50 hours on an engine test stand during which the demodulated signals were observed and additional data were obtained relative to the system stability. Author (TAB)

N70-16138*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INVESTIGATION OF LEVEL-FLIGHT AND MANEUVERING CHARACTERISTICS OF A HINGELESS-ROTOR COMPOUND HELICOPTER

Julian L. Jenkins, Jr. and Perry L. Deal Washington Jan. 1970 33 p refs
(NASA-TN-D-5602; L-6661) Avail: CFSTI CSCL 01C

The results of a flight-test program utilizing a hingeless-rotor compound helicopter are discussed. Data are presented to indicate the level-flight performance characteristics, speed stability, maneuver stability, and wing rotor lift sharing in maneuvering flight. Also included are data indicating the rotor rotational-speed control characteristics during maneuvers and during simulated main-rotor power failures. The data show that there is an inherent reduction in rotor lift as level-flight airspeed is increased. In addition, a reduction in rotor-lift sensitivity in maneuvering flight was measured and determined to be dependent on the stability of the aircraft in maneuvering flight. Although the lift-sharing trends contribute favorably to the piloting task in the compound mode, the rotor overspeed tendencies could require constant pilot attention during maneuvering flight. Author

N70-16238*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AIRWORTHINESS CONSIDERATIONS FOR STOL AIRCRAFT

Robert C. Innis, Curt A. Holzhauser, and Hervey C. Quigley Washington Jan. 1970 69 p refs
(NASA-TN-D-5594; A-3077) Avail: CFSTI CSCL 01C

Criteria are presented for satisfactory performance and handling qualities of powered-lift STOL transport aircraft in commercial operation. These criteria were formulated from information gathered during NASA flight tests of STOL aircraft. The main emphasis is placed on the landing-approach mode because this regime has caused the greatest difficulty and is the most demanding portion of the flight. It was concluded that STOL aircraft utilizing power to develop lift can safely approach and land with smaller speed margins than conventional aircraft. No single field length factor that would relate a demonstrated performance to an operational field length could be developed because insufficient data were available. Mechanical control characteristics are more important in overall handling than they are for conventional aircraft because the stability and damping are generally low at STOL speeds. High levels of aerodynamic stability and damping are not necessarily desired because they allow the aircraft to be more easily disturbed in gusty air. Additional research is necessary for determining more accurately the effect of gusts, shears, and crosswinds on performance and handling qualities. Author

N70-16357# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

THE MEASUREMENT OF THE EFFECTS OF SLUSH AND WATER ON AIRCRAFT DURING TAKE-OFF. PART 1: THE TECHNIQUE. PART 2: RESULTS OF MEASUREMENTS ON THREE AIRCRAFT

M. V. Slatter and R. L. Maltby London HMSO 1969 72 p refs Supersedes RAE-TR-65175; ARC-27529 and RAE-TR-68107; ARC-30445
(ARC-R/M-36043; RAE-TR-65175; ARC-27529; RAE-TR-68107; ARC-30445) Copyright. Avail: HMSO: £1 17s 6d; $7.20; CFSTI

A technique for measuring the effect of slush and water on aircraft during take-off is described. The construction of water ponds on the runway, the test instrumentation, and the interpretation of the results are covered. The results of drag and water spray measurements on a Canberra, an Ambassador, and a Viscount aircraft are presented and compared with results from other aircraft. It is suggested that for estimating purposes a slush drag coefficient value of 1.0 and spray angles angles of 40 deg to 50 deg in front elevation and 20 deg in side elevation can be used. Author (ESRO)

N70-16468# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Flight Environment Branch.

LONG-LINE LOITER: IMPROVEMENT OF SOME FREE-FALL AND CIRCLING-LINE TECHNIQUES Technical Report, Jun.–Dec. 1968

John C. Simons and B. C. Dixon (Lear Siegler, Inc., Santa Monica, Calif.) Sep. 1969 37 p refs
(AD-695800; ASD-69-95-Vol-1) Avail: CFSTI CSCL 1/3

Maneuvering techniques for fixed-wing aircraft positioning a towed mass near the center of an on-pylon are discussed. Free-fall and circling-line techniques were improved and several applications demonstrated. Successful ground launching of 100 pound masses with the system prompted a decision to man-rate it for air to ground pickup of personnel. New delivery and retrieval methods are discussed. Future efforts involving longer lines and heavier masses are discussed in terms of flying lines, lifting surfaces, a long-line loiter (LLL) simulator, and a large cabin aircraft. Author (TAB)

N70-16494# Federal Aviation Agency, Atlantic City, N.J. National Aviation Facilities Experimental Center.
AN EVALUATION OF THE C-141 CATEGORY 3 ALL-WEATHER LANDING SYSTEM Final Report
Lyle B. Marshall Oct. 1969 172 p refs
(AD-695804; NA-69-18; FAA-RD-69-34) Avail: CFSTI CSCL 1/2

A flight test evaluation of a C-141 All-Weather Landing System (AWLS) proposed for use in Category IIIB landing weather minima was conducted. Over 300 approaches were conducted under simulated Category III conditions. The primary area of interest was decrab, touchdown and rollout to full stop since the basic AWLS was already certified for operation in Category II landing weather minima. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-15538# Technische Hochschule Munchen (West Germany).
ELECTROCHEMICAL STUDIES ON HIGHLY POROUS CARBON ELECTRODES [ELEKTROCHEMISCHE UNTERSUCHUNGEN AN HOCHPOROESEN KOHLEELEKTRODEN]
Peter Bertsch (Ph.D. Thesis) 2 Jul. 1969 110 p refs *In* German
Avail: CFSTI

The electrochemical behavior of carbon electodes with regulated pore distribution was studied and compared with other porous electrode materials for their application in hydrogen–oxygen fuel cells. Various electrochemical studies were performed to determine electrode kinetics and to calculate the potential time curve of the galvanostatic switch-on process. Transl. by G.G.

N70-15599# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.
THE USE OF AN ELECTRON CARRIER SYSTEM OF AMMONIUM CHLORIDE–COPPER SULFATE AS A BIOCHEMICAL REACTION CELL
Jun Mizuguchi, Shuichi Suzuki, and Kentaro Kashiwaya Bedford, Mass. AFCRL Oct. 1969 16 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi, (Tokyo), v. 67, no. 11, 1964 p 1887–1889
(Contract F19628-68-C-0251)
(AD-696097; EMM-69-224; AFCRL-69-0430; Trans-59) Avail: CFSTI CSCL 10/2

A biological electron carrier system has been analyzed as aspects of anode and cathode reactions of a biochemical reaction cell. The p-benzoquinone-hydroquinone redox system, whose catalytic properties are similar to laccase, was treated as the cathode portion of a fuel cell. The ammonium chloride-copper sulphate system was found to be as effective as laccase in the oxidation of hydroquinone by aeration. The cathode potential of the combined p-benzoquinone-hydroquinone and ammonium chloride-copper sulphate aerated system was +0.2 V(vs. normal hydrogen electrode) at 1.25 mA/sq. cm. The electron carrier system consisting of ammonium chloride-copper sulphate and p-benzoquinone-hydroquinone showed the same effects as the laccase and p-benzoquinone-hydroquinone systems. Both may be interpreted as cathode reactions. Author (TAB)

N70-15674# Air Force Cambridge Research Labs., Bedford, Mass.
BIOCHEMICAL FUEL CELLS
Miroslav Cenek Aug. 1969 65 p refs Transl. into ENGLISH from Chemicke Listy, (Czechoslovakia), v. 62, no. 8, 1968 p 927–974
(AD-694072; AFCRL-69-0351; AFCRL-Trans-54) Avail: CFSTI CSCL 10/2

A review is provided which covers the development, present status, and future outlook of biochemical fuel cell research. Its contents include: Bioelectrochemistry; Biofuel cells; (Fuels for Biofuel cells, Oxidation agents for biofuel cells, Organisms for biofuel cells, Classification of biofuel cells, Electrochemical and biological metabolism, Interelectrode separation, Suitability of materials used in Biofuel Cells, The influence of the Electrode on the Biological Substance); Biogalvanic cells; Biosolar cells; Bioanodes; Biocathodes; Some types of biofuel cells (Biofuel cell urea-oxygen-urease, Biofuel cell lactate-atmospheric oxygen); Comparison of biofuel cells with fuel cells (Advantages of biofuel cells over fuel cells, Drawbacks of biofuel cells in comparison with fuel cells); The medium of the ocean as a giant biofuel cell. Author (TAB)

N70-15699# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.
FUEL CELLS USING ORGANIC REDOX COMPOUNDS
Jun Mizuguchi et al Bedford, Mass. AFCRL Oct. 1969 18 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 65, no. 10, 1962 p 1606–1608
(Contract F19628-68-C-0251)
(AD-696096; EMM-69-222; AFCRL-69-0425; Trans-56) Avail: CFSTI CSCL 10/2

In living systems, hydrogen supplied from the TCA cycle is transferred to molecular oxygen and oxidized by the electron carrier system, thereby generating energy. It appears that the reversible redox system such as the electron carrier system has not yet been studied in vitro. It was considered that the system of cystine-cysteine containing ferric ion or that of quinone-hydroquinone containing an enzyme might act like the electron carrier system. The authors attempted to use the electron carrier system at the cathode of a fuel cell to obtain a greater amount of electric current. As a result, it has been demonstrated that a fuel cell, based on the model of carrier systems, shows the properties of larger current density and capacity than the ordinary fuel cell and following the model of the carrier system, oxidation and reduction can be repeated alternately without consumption of reactants. Author (TAB)

N70-15843# Gulf General Atomic, San Diego, Calif.
PERFORMANCE EVALUATION OF A THERMIONIC CONVERTER USING A GRAPHITE INTEGRAL RESERVOIR
A. J. Gietzen 16 Apr. 1969 22 p refs
(Contract AT(04-3)-167)
(GA-9163) Avail: CFSTI

An analytical evaluation of a graphite integral reservoir as a cesium supply in a thermionic converter is described. The reservoir is thermally coupled to the emitter and collector such that its temperature is determined by the electrode temperatures. The collector temperature depends in a passive manner on the thermal power rejected. The thermal model of the converter and reservoir is presented. The analysis includes performance obtained with specific designs incorporating the reservoir into the converter. The

current-voltage characteristics are computed over the entire range of input power from startup to full power. The results indicate that close coupling of the graphite reservoir to the collector causes a peak in emitter temperature in the input power range of 30 to 60% of full power, resulting from inadequate cesium coverage for good electron emission. Author (NSA)

N70-15883*# Boeing Co., Seattle, Wash. Aerospace Group.
INVESTIGATION INTO THE MECHANISM OF DEGRADATION OF SOLAR CELLS WITH SILVER-TITANIUM CONTACTS Progress Report, 1 Jul. – 30 Nov. 1969
Nov. 1969 26 p refs
(Contract NASw-1859)
(NASA-CR-107619; D2-126194-2) Avail: CFSTI CSCL 10B

Electrochemical behavior of titanium in the presence of halogens at various values of pH was studied. Physical measurements were made to characterize the silicon substrate of solar cells. Experiments were undertaken to measure the porosity of the silver contact layer on solar cells. Some of the significant results of the work are: (1) Titanium corrosion can occur under conditions of moderately acidic pH in the presence of F(–). (2) Chemical etching of the silicon wafers causes the mottled appearance of the solar cell contacts. Evaporated titanium and silver reflect the contours of the silicon substrate. (3) Silicon wafers prior to contact deposition contain F(–). (4) The porosity of silver to humidity has been tentatively verified, but an unexplained blistering of titanium free silver on silicon was observed. Author

N70-16217# Advisory Group for Aerospace Research and Development, Paris (France).
SPACE POWER SYSTEMS, PART 1 Lecture Series
Nov. 1969 348 p refs Presented at Brussels, 2 – 6 Oct. 1967
Sponsored by AGARD
(AGARDograph-123-Pt-1) Avail: CFSTI

CONTENTS:

1. SIMILITUDES AND LIMITATIONS IN TRANS-CONVENTIONAL PROPULSION SYSTEMS G. C. Szego (Inst. for Defense Analyses, Arlington, Va.) p 1–19 refs (See N70-16218 05-27)

2. SPACE POWER SYSTEMS G. C. Szego (Inst. for Defense Analyses, Arlington, Va.) p 21 – 89 refs (See N70-16219 05-03)

3. NUCLEAR SPACE POWER SYSTEMS H. M. Dieckamp p 91 – 302 refs (See N70-16220 05-22)

4. MECHANICAL HEAT ENGINES FOR SPACE POWER SYSTEMS E. B. Zwick p 303 – 348 refs (See N70-16221 05-28)

N70-16219# Institute for Defense Analyses, Arlington, Va.
SPACE POWER SYSTEMS
George C. Szego *In* AGARD Space Power Systems, Pt. 1 Nov. 1969 p 21 – 89 refs (See N70-16217 05-03)
Avail: CFSTI

Space power systems are divided into three basic subsystems of an energy source or collector, a conversion system, and a waste-heat rejection system. There are strong interactions among the three subsystems which lead to numerous trade-off possibilities and optimization. The various factors affecting the operation of each of the subsystems are discussed and different types of power generation sources are considered. R.B.

N70-16222# Advisory Group for Aerospace Research and Development, Paris (France).
SPACE POWER SYSTEMS, PART 2 Lecture Series
Nov. 1969 304 p refs Presented at Brussels, 2 – 6 Oct. 1967
Sponsored by AGARD
(AGARDograph-123-Pt-2) Avail: CFSTI

CONTENTS:

1. TURBOMACHINERY FOR SPACE POWER E. B. Zwick p 351 – 369 refs (See N70-16223 05-28)

2. ALTERNATORS FOR SPACE POWER APPLICATIONS E. B. Zwick p 371 – 396 refs (See N70-16224 05-03)

3. TECHNOLOGY OF THERMOELECTRIC AND THERMIONIC ENERGY CONVERSION N. S. Rasor p 397 – 413 refs (See N70-16225 05-03)

4. ENGINEERING ASPECTS OF THERMIONIC ENERGY CONVERSION N. S. Rasor p 415 – 441 refs (See N70-16226 05-03)

5. ELECTROCHEMICAL SPACE POWER SOURCES E. M. Cohn (NASA, Washington, D.C.) p 443 – 501 refs (See N70-16227 05-03)

6. PHOTOVOLTAIC DEVICES AND SYSTEMS M. Rodot (CNRS, Meudon, France) and H. Daspet (CNES, Bretigny-sur-Orge, France) p 503 – 602 refs (See N70-16228 05-29)

7. OPTIMIZATION OF ENERGY STORAGE FOR SOLAR SPACE POWER, APPENDIX 1 G. C. Szego and B. Paiewonsky (Inst. for Defense Analyses, Arlington, Va.) p 603 – 618 (See N70-16229 05-03)

8. PANEL DISCUSSION ON SPACE POWER SOURCES G. C. Szego (Inst. for Defense Analyses, Arlington Va.) p 619 – 648 (See N70-16230 05-03)

N70-16224# Advisory Group for Aerospace Research and Development, Paris (France).
ALTERNATORS FOR SPACE POWER APPLICATIONS
Eugene B. Zwick *In its* Space Power Systems, Pt. 2 Nov. 1969 p 371 – 396 refs (See N70-16222 05-03)
Avail: CFSTI

Dynamic space power systems normally use alternators as a means of converting mechanical to electrical energy. Direct current machines are usually unsuitable because of problems with brushes and commutators in a severe environment. Electrostatic machines are discussed briefly. Alternators used in missile and space power applications include many of the types already developed for ground power use. Requirements for very high temperatures, corrosive environments, and extremely high rotative speeds have led to innovations in alternator design. The new machinery which has been developed shows considerable promise for future application in both space and terrestrial use. Author

N70-16225# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNOLOGY OF THERMOELECTRIC AND THERMIONIC ENERGY CONVERSION
Ned S. Rasor *In its* Space Power Systems, Pt. 2 Nov. 1969 p 397 – 413 refs (See N70-16222 05-03)
Avail: CFSTI

A general definition of thermoelectricity includes all effects which produce electric currents as a result of a temperature difference, excluding those employing the motion of mechanical or fluid components. Although a large number of such effects exist, only two approaches have been demonstrated to be significant for practical power generation. These two approaches, semiconductor thermocouple and thermionic energy conversion, are discussed in detail. Both thermoelectric (thermocouple) and thermionic energy converters are heat engines which use an electron gas as their working fluid. The elementary nature of this fluid and the associated properties which are important in thermoelectricity are reviewed. Author

N70-16226# Advisory Group for Aerospace Research and Development, Paris (France).
ENGINEERING ASPECTS OF THERMIONIC ENERGY CONVERSION
Ned S. Rasor *In its* Space Power Systems, Pt. 2 Nov. 1969 p 415 – 441 refs (See N70-16222 05-03)

Avail: CFSTI

The status of thermionic converter development is outlined from the viewpoint of prospective engineering use. The research upon which the description is based is reviewed elsewhere. Also, a perspective of recent trends is taken in describing progress toward practical application, rather than a review of past work. Special attention is given the broadening spectrum of new approaches which have arisen in response to changes in requirements, especially when viewed on an international scale. The engineering utility of the present understanding, and the potential impact of research in progress, is illustrated by specific examples of their application in these new approaches. Author

N70-16227*# National Aeronautics and Space Administration, Washington, D.C.

ELECTROCHEMICAL SPACE POWER SOURCES

Ernst M. Cohn *In* AGARD Space Power Systems, Pt. 2 Nov. 1969 p 443–501 refs (See N70-16222 05-03)

Avail: CFSTI CSCL 10B

Because of the convenience, efficiency, and simplicity of chemical energy storage combined with electrochemical production of electricity, galvanic batteries powered the first airborne and the first spaceborne on-board electrical systems. After a general discussion of electrochemical energy storage and electricity generation in space, the paper presents the thermodynamic and kinetic electrochemical basis for these devices, as well as criteria for selecting electrochemically active materials and estimating densities. The following three sections cover primary (single use) and secondary (rechargeable) equipment, either now being used or of potential usefulness in space. The last two sections relate some design criteria for space power systems and consider possible earth-bound applications of space-oriented electrochemical research and development. Author

N70-16229# Institute for Defense Analyses, Arlington, Va.

OPTIMIZATION OF ENERGY STORAGE FOR SOLAR SPACE POWER, APPENDIX 1

G. C. Szego and B. Paiewonsky *In* AGARD Space Power Systems, Pt. 2 Nov. 1969 p 603–618 (See N70-16222 05-03)

Avail: CFSTI

In the area of thermal conversion of solar energy, it is assumed that energy storage should be carried out by floating a thermal storage system which stores heat energy usually in the form of latent heat of phase change, which operates in such a way as to provide thermal energy to the conversion system from storage during periods of non-illumination by the sun. Commonly obtainable conditions are discussed under which it becomes appropriate on a mass minimization basis either to store the energy during illuminated periods in the form of electrical energy or to combine thermal energy storage with electrical energy storage. An analysis is given on the basis of which the optimal system or combination can be predicted. The parameter variation limits have been chosen so that virtually all conceivable conditions of operation and performance of the conversion and storage elements are covered. R.B.

N70-16230# Advisory Group for Aerospace Research and Development, Paris (France).

PANEL DISCUSSION ON SPACE POWER SOURCES, APPENDIX 2

George C. Szego (Inst. for Defense Analyses, Arlington, Va.) *In* its Space Power Systems, Pt. 2 Nov. 1969 p 619–646 (See N70-16222 05-03)

Avail: CFSTI

The technologies, disciplines and arts which have been found necessary for the development of space power systems have generated advances in many fields of energy conversion and engineering because of the pressing requirements for minimum mass, minimum volume and at the same time, extraordinarily high reliability. Space power systems have evolved as an aspect of the new discipline: systems engineering. Similarly, conventional energy conversion thermodynamics, while still correct, often have entirely different influence and effect than when energy conversion is practised terrestrially. In addition, a hostile environment of high speed micrometeorites, of total vacuum, unavailability of convection and conduction, and the total absence of normal gravity effects, create boundary conditions of the utmost challenge to the technologist. Author

N70-16331 National Lending Library for Science and Technology, Boston Spa (England).

IMPROVED TECHNIQUE FOR DETERMINING THE CAVITATION RESISTANCE OF METALS USED IN HYDRAULIC TURBINES

M. G. Timarbulatov 21 Jul. 1969 9 p refs Transl. into ENGLISH from Zavodsk. Lab. (Moscow), v. 34, no. 12, p 1508–1511 In ENGLISH and RUSSIAN

(NLL-LTI-746-130-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The erosion coefficient for corrosion resistant and stainless steels under service conditions was employed to improve a laboratory test technique based on alternating cavitation and corrosion effects in a magnetostrictive vibrator. It was found that the corrosion factor in the operation of hydraulic turbine blades plays a much greater part than was previously supposed. The corrosion factor in a magnetostrictive vibrator may be intensified by adding corrosion-active reagents while at the same time reducing the severity of the cavitation factor by decreasing the vibration amplitude. After decreasing the vibration amplitude, results were obtained that closely resembled those recorded under operating conditions. D.L.G.

N70-16378# Army Electronics Command, Fort Monmouth, N.J.

INVESTIGATION OF A HIGH-ENERGY DENSITY MOLTEN SALT BATTERY SYSTEM Research and Development Technical Report

Wishvender K. Behl and David L. Beals Aug. 1969 23 p refs (AD-694368; ECOM-3168) Avail: CFSTI CSCL 10/3

The report describes an investigation of high-surface-area carbon and carbon-tungsten composite electrodes as cathode materials for a high-energy density molten salt battery. These electrodes were evaluated by studying the charge-discharge characteristics of the cell. The tungsten content in the composite electrodes was varied from zero to 75 weight percent and the capacities of the high-surface-area carbon and carbon-tungsten composite electrode were determined. The investigation was also extended to other binary and ternary molten halide electrolytes. Author (TAB)

N70-16379*# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.

STUDIES IN FUNDAMENTAL CHEMISTRY OF FUEL CELL REACTIONS Quarterly Report, 1 Apr. – 30 Jun. 1969

John O'M. Bockris 30 Jun. 1969 51 p

(Grant NGR-39-010-002)

(NASA-CR-107590; QR-2) Avail: CFSTI CSCL 10B

Reported are the developments in these projects: theoretical study of electrocatalysis, study of the dendritic deposition of zinc from alkaline solution, reversibility studies of ion adsorption on solid electrodes, and sodium diffusion in crystals. In the study of the dendritic deposition of zinc, the influence of lead concentration upon the initiation and propagation of zinc dendrites are tabulated. F.O.S.

N70-16403*# CARA Corp., Philadelphia, Pa.

THE RELATION BETWEEN SOLAR CELL FLIGHT PERFORMANCE DATA AND MATERIALS AND MANUFACTURING DATA Quarterly Report

S. R. Pollack [1969] 38 p
(Contract NASw-1732)
(NASA-CR-107726; QR-5) Avail: CFSTI CSCL 10B

The purpose of this contract is to examine the flight performance data for solar cell power systems in satellites, and to try to relate the differences in performance to the materials and manufacturing factors in the solar cell system. Presented is a history covering the selection of the flights for detailed study. The methods of acquiring information concerning these flights are also discussed. A list of the available telemetry data for each flight in the study is also presented, along with the reasons why a flight was, or was not chosen for detailed study. The attempts made to retrieve the data for the flights chosen for detailed study are described. Opinions are presented as to the reasons why the data could not be obtained and recommendations are made for the future. Author

N70-16842*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
ROLLUP SUBSOLAR ARRAY Quarterly Report, 1 Sep.–30 Nov. 1969
15 Dec. 1969 123 p refs
(Contracts NAS7-100; JPL-952314)
(NASA-CR-107739; GE-SSO-69SD4373; QR-3) Avail: CFSTI CSCL 10B

Results of the activities to design and to develop the technology of a 30-watt per pound rollup solar array are reported. The major effort was devoted to the fabrication of the probotype test model, to detailed planning associated with system testing, and to the design of support equipment. The progress of the array substrate fabrication is documented. An integrated system test flow is presented along with a description of each test. The supporting test equipment is described. Author

N70-16874*# Textron Electronics, Inc., Sylmar, Calif.
DEVELOPMENT OF LITHIUM DIFFUSED RADIATION RESISTANT SOLAR CELLS Quarterly Report
15 Oct. 1969 17 p Prepared for JPL
(Contracts NAS7-100; JPL-952547)
(NASA-CR-105857; QR-1; Rept-3) Avail: CFSTI CSCL 10B

Boron diffusion was investigated. Areas of the lithium cell investigation are dependent upon obtaining a relatively stress free boron diffusion, which is impossible with the BCl3 diffusion typically used. Experiments to investigate various material parameters were also designed. The first lot of lithium cells was fabricated and delivered, and an output analysis is included. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-15516# Colorado Univ., Denver. Medical Center.
THE EFFECT OF HYPOXIA ON THE PULMONARY MICROCIRCULATION Annual Progress Report, 1 Oct. 1968–30 Sep. 1969
Wiltz W. Wagner, Jr. 1 Oct. 1969 18 p refs
(Contract DADA17-68-C-9071)
(AD-695693; APR-2) Avail: CFSTI CSCL 6/5

A technique designed to permit direct microscopic observation via a transparent window implanted in the chest wall of dogs of the pulmonary capillaries in vivo has been developed. Cine- and photomicrographic techniques have been developed to permit high speed, high resolution study of the pulmonary microcirculation. These systems have been designed to provide information related to the following: The velocity of the erythrocytes as they cross the alveolar capillary net to determine contact time between oxygen and hemoglobin; The orientation of the erythrocytes in the capillaries to determine the intracapillary diffusion distance of molecular oxygen; The site of action of the hypoxic vasopressor response; and The quantitation of the oxyhemoglobin gradient along the microcirculation to determine (a) the boundaries of the oxygen uptake process, (b) the shape of the uptake curve, and (c) how the curve and boundaries are affected by stress, e.g. hypoxemia or exercise. Author (TAB)

N70-15545# Dunlap and Associates, Inc., Santa Monica, Calif.
ADAPTIVE TECHNIQUES IN MEASURING COMPLEX PERFORMANCE Final Report
Charles R. Kelley and Daniel J. Prosin 15 Sep. 1969 67 p refs
(Contract Nonr-4986(00))
(AD-694523) Avail: CFSTI CSCL 5/10

The problem of the measurement of the performance of operators of complex military systems is discussed. Typical Navy tasks and taxonomies for describing and classifying such tasks are reviewed. The problem of the reliability of normative vs. differential measurements is analyzed. At least five approaches are available to measure complex task performance: (1) actual operational measurements; (2) simulated tasks; (3) synthetic tasks; (4) loading tasks; and (5) psychophysiological measurements. Sensing, information processing, planning and action systems are discussed briefly. Author (TAB)

N70-15552# Pennsylvania State Univ., University Park. Dept. of Zoology.
ADAPTATION TO CHRONIC HYPERBARIC OXYGEN PRESSURES Final Scientific Report, 1 May 1966–31 Sep. 1969
Rodney T. Houlihan 17 Sep. 1969 8 p refs
(Contract Nonr-656(36))
(AD-695822; FP-1-69) Avail: CFSTI CSCL 6/19

The report summarizes the research on the effects of hyperbaric medicine completed at the Pennsylvania State University. The progression of this research involved studies on renal function, blood flow, adrenocortical and sympatho-adreno-medullary (SAM) activity. The blood flow alterations indicated increased adrenocortical function. The adrenocortical function reaches its highest level just prior to death from oxygen poisoning. The excretion of catecholamine indicated an altered metabolism of epinephrine. It is noted that oxygen at high pressure results in the production of adrenochrome, adrenolutin and derivatives. These compounds are highly reactive and can account for the manifestations of oxygen toxicity. Author (TAB)

N70-15568*# Naval Aerospace Medical Inst., Pensacola, Fla.
OFF-VERTICAL ROTATION: A CONVENIENT PRECISE MEANS OF EXPOSING THE PASSIVE HUMAN SUBJECT TO A ROTATING LINEAR ACCELERATION VECTOR
Ashton Graybiel and Earl F. Miller, II 17 Oct. 1969 14 p refs
(NASA Order R-93; NASA Order T-81633)
(NASA-CR-107822; NAMI-1090) Avail: CFSTI CSCL 06S

The study of disturbances of vestibular origin comprising the clinical picture of motion sickness and resulting from exposure to a rotating linear acceleration vector was carried out with a rotating chair modified to permit tilting up to 20 deg away from the upright. While rotating at constant velocity at a given angle of tilt, the subject was thus exposed to a continual change with reference to the gravitational upright. Stepwise increases in the level of stress were effected through automatic programming of the chair's angular velocity. Subjects were exposed until either they experienced mild motion sickness (the predetermined endpoint), or

the cut-off point, a terminal velocity of 25 rpm at 10 deg tilt, was reached. Of the group of 100 healthy men, 88 reached the predetermined endpoint; all but 5 of the remainder reached it only when the angle of tilt was increased to 20 deg. Thus, the scores ranked 95 subjects in terms of their susceptibility to this unusual gravitoinertial force environment and demonstrated that 5 were highly insusceptible. The accuracy and flexibility of the method should prove it to be useful, not only as a provocative test of susceptibility to motion sickness but also a means of studying the symptomatology and underlying mechanisms. Author

N70-15634*# Naval Aerospace Medical Inst., Pensacola, Fla.
ADAPTATION TO CORIOLIS ACCELERATIONS: ITS TRANSFER TO THE OPPOSITE DIRECTION OF ROTATION AS A FUNCTION OF INTERVENING ACTIVITY AT ZERO VELOCITY
James T. Reason and Ashton Graybiel 5 Aug. 1969 21 p refs (NASA Order R-93)
(NASA-CR-107623; NAMI-1086; Rept-168) Avail: CFSTI CSCL 06S

To determine how adaptation to Coriolis accelerations, acquired through controlled head movements in a room rotating in one direction, transfers to the opposite direction as a consequence of the stimulus mode during an intervening period at zero velocity. Under one experimental condition the subjects continued to make the same head movements during this period as those used to acquire perrotational adaptation, thus evoking postrotational responses opposite in sign but similar in quality to those experienced during the initial period of rotation. Under the other condition mechanical restraints were applied to the head and torso for an equivalent period of time. Subjects who performed head motions during the intervening static period were able to adapt more rapidly to the second (opposite) direction of rotation than to the first. In addition, the intervening activity appeared to confer some immunity to motion sickness during the second direction of rotation. Postrotational effects following the second direction of rotation were less severe and of shorter duration than those experienced following the initial period of rotation. The opposite findings were obtained for those subjects who remained immobilized during the intervening period at zero velocity. Author

N70-15635*# National Aeronautics and Space Administration, Washington, D.C.
COMBINED ACTION OF CARBON MONOXIDE AND HYDROGEN SULFIDE [KOMBINIROVANNOYE DEYSTVIYE OKISI UGLERODA I SEROVODORODA]
R. K. Melnichenko Jan. 1970 6 p refs Transl. into ENGLISH from Vrachebnoe delo (Kiev), no. 7, Jul. 1968 p 87–90
(NASA-TT-F-12721) Avail: CFSTI CSCL 06C

Experiments conducted on white rats, exposed for six months to the effect of 0.3 ml/l of carbon monoxide and to the combination of 0.3 ml/l. of carbon monoxide with 0.05 ml/l. hydrogen sulfide, showed a marked toxic effect of the carbon monoxide and hydrogen sulfide combination. Data of previous acute experiments and results of this study suggested the necessity to reconsider the present hygienic standards of work in conditions of the combined effect of carbon monoxide and hydrogen sulfide. Author

N70-15709*# Battelle-Northwest, Richland, Wash. Biology Dept.
STUDY OF EARLY NAUSEA AND VOMITING RESPONSE OF SWINE TO IONIZING RADIATION Final Technical Progress Report, 15 Sep. – 12 Dec. 1969
Maurice F. Sullivan Dec. 1969 38 p refs
(Contract NAS9-9188)
(NASA-CR-102076) Avail: CFSTI CSCL 06R

Numerous reports attest to the fact that humans experience a prodromal response following exposure to ionizing radiation, either as a result of radiation-therapy treatments or as a consequence of accidental exposure. It is entirely possible that the magnitude of the doses which in some cases cause this response would be encountered during space missions, whether of an intra- or an extra-vehicular nature. Although such a response is uncomfortable and distressing in our normal environment, it could conceivably result in death in a hostile environment. While being merely temporarily incapacitating on earth, in a high performance and reliability situation such incapacitation, however temporary, might lead to an aborted, an incompleted, or even a fatal mission. Furthermore, the consequences of the vomit reflex in a weightless environment are not yet known. It may be that the consequences of such vomiting would be longer than of a temporary nature, such that the performance of the individual might be seriously reduced or terminated altogether. Author

N70-15773# Air Force Systems Command, Wright-Patterson AFB, Ohio. Human Resources Lab.
A FUNCTIONAL MODEL OF MEMORY BASED ON PHYSIOLOGICAL AND VERBAL LEARNING DATA Technical Report Jun. – Aug. 1968
Peter J. Kincaid Jun. 1969 40 p refs
(AD-694078; AFHRL-TR-68-16) Avail: CFSTI CSCL 5/10

The report presents a functional model of memory based on verbal learning and physiological data. These diverse empirical data are used to describe several basic mechanisms of memory including: (a) separate mechanisms for short-term memory and for long-term memory; (b) the initiation of long-term memory by short-term memory; (c) the properties of short-term memory including autonomous decay, distortion by interference, and a limited capacity; (d) the properties of long-term memory including a consolidation process dependent upon ribonucleic acid (RNA) and enzymes, and a very large capacity; (e) the functional grouping of items in long-term memory; and (f) consolidated (long-term) memories that are reactivated, being brought back into short-term memory. Time courses of these events are described. The report describes how mnemonic techniques work and presents suggestions about how to improve memory training. Author (TAB)

N70-15786# Denver Univ., Colo. Dept. of Psychology.
INTEGRATION OF INFORMATION WITH STIMULI IN CONTINUOUS MOTION
Z. Joseph Ulehla and Joseph Halpern Oct. 1969 29 p refs
(Contract N00014-67-A-0394)
(AD-695406; TR-3) Avail: CFSTI CSCL 5/10

Research concerned with information integration has led to conflicting results with respect to the predictions of the integration model of the theory of signal detectability. One difference between auditory or conceptual tasks and visual involves the presence or absence of within-trial stimulus variability. The present experiment employed stimuli in motion which were non-redundant. The results were similar to those obtained with the more static, redundant visual stimuli. It was suggested that the integration model might be invalid in that it predicts integration superior to what Ss are capable of and that the frequent good fit of data to theory is an artifact based on orienting properties of the first stimulus presentation. Author (TAB)

N70-15789*+ Sandia Corp., Albuquerque, N. Mex.
CONTAMINATION CONTROL, A STATE-OF-THE-ART REVIEW
W. J. Whitfield and D. M. Garst Nov. 1968 18 p Presented at Bell System Contamination Control Symp., Allentown, Pa., 12 Nov. 1968
(NASA Order W-12324; NASA Order H-13248A)
(NASA-CR-107700; PB-182927; SC-R-69-1154) Avail: CFSTI CSCL 06Q

A review is presented of the current status of contamination control, covering, in a general fashion, the areas of systems analysis, product design, facilities and equipment, monitoring, and personnel as they are related to contamination control. Author

N70-15795*# Ohio State Univ. Research Foundation, Columbus. Dept. of Preventive Medicine.
CARDIOVASCULAR EFFECTS OF VIBRATION, PART 2 Final Report, 31 Jul. 1968 – 31 Jul. 1969
Lester B. Roberts Jul. 1969 94 p refs
(Grant NGR-36-008-041)
(NASA-CR-107626; Rept-6) Avail: CFSTI CSCL 06S

Each of two volunteer subjects was sinusoidally vibrated (unrestrained, front – back, and transversely while seated) at various intensities. Frank lead orthogonal electrocardiograms were recorded on magnetic tape during the complete test and control periods. Beat-by-beat pulse rate curves and certain vectocardiographs were also obtained from the stored recorded data. Blood pressure readings (cuff) obtained approximately 30 seconds after termination of each vibration are shown on the pulse rate curves. Inspection of the orthogonal scaler electrocardiograms considered together shows them to be generally acceptable for clinical evaluation. No evidence of extrasystoles was detected in the recordings. Changes in the subjects' electrocardiograms which occurred during vibration did not persist after vibration nor did the changes suggest undue stress or any other than normal physiological variations. There seems to be no consistent pattern of pulse rate change for either subject when vibrated. Author

N70-15867# Northwestern Univ., Evanston, Ill. Dept. of Psychology.
THE UTILIZATION OF BEHAVIORAL SCIENCE RESEARCH FOR AN APPLIED PROBLEM: THE MANAGEMENT OF CRISES Technical Report
Thomas W. Milburn 15 May 1969 49 p refs
(Contract N00014-67-A-0356)
(AD-695809; TR-2) Avail: CFSTI CSCL 5/10

The document is concerned with crises, which may be regarded as complex stressors that involve threat, decision pressure, and a need to improvise. It considers some of the stress literature relevant to the study of crises, and refers to laboratory and simulation studies. Crisis management is held to involve information (uncertainty), the selection and training of personnel, and control either for purposes of attenuation or for exploitation. Author (TAB)

N70-15895# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Hamburg (West Germany). Inst. fuer Flugmedizin.
CHANGES IN THE FACTOR STRUCTURE OF A PSYCHOMOTOR TEST BY TRAINING, DEPENDENT ON FORE AND AFT SEQUENCE OF REFERENCE TESTS [AENDERUNGEN DER FAKTORENSTRUKTUR EINES PSYCHOMOTORISCHEN TESTS DURCH UEBUNG, IN ABHAENGIGKEIT VON DER PLAZIERUNG DER BEZUGSTESTS]
Peter Buttgereit (Ph.D. Thesis—Hamburg Univ.) May 1969 91 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-26; DVL-842) Avail: CFSTI

Psychomotor performance tests are described for determining the dependence of the results on additional reference tests and on the order of the tests. The analysis is based on the concept of factorization of the test variables and proceeds by matrix transformation methods. It is found that with increasing practice the factor structure is simplified and a change from cognitive factors to psychomotor factors takes place. Author (ESRO)

N70-15908# Massachusetts Inst. of Tech., Cambridge. Dept. of Psychology.
THE INFLUENCE OF OCULOMOTOR SYSTEMS ON VISUAL PERCEPTION Final Report
Whitman Richards Jul. 1969 128 p refs
(Contract F44620-67-C-0085)
(AD-694113; AFOSR-69-1934TR) Avail: CFSTI CSCL 6/16

The report summarizes work on the influence of the influence of the oculomotor systems upon perception. Two general problems were considered: saccadic suppression and size-scaling. Of particular interest is whether or not efferent or outflow mechanisms play a significant role in these perceptual phenomena. Author (TAB)

N70-16001# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 3, NO. 5
31 Dec. 1969 130 p refs Transl. into ENGLISH from Kosmich. Biol. i Med. (Moscow), v. 3, no. 5, 1969 p 1–88
(JPRS-49533) Avail: CFSTI

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N70-16002# Joint Publications Research Service, Washington, D.C.

PHYSIOLOGIC AND HYGIENIC BASIS FOR A RATIONAL GAS MEDIUM IN SPACESHIP CABINS

N. A. Agadzhanyan *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 1–14 refs (See N70-16001 05-04)

Avail: CFSTI

Physiologically substantiated data on the total pressure and partial pressure of oxygen is presented in the atmosphere of spaceship cabins used during missions of short and long duration. Animal studies have revealed a relationship between the atmospheric environment and tolerance to hypoxia. Author

N70-16003# Joint Publications Research Service, Washington, D.C.

MORPHOLOGICAL CHANGES IN PARENCHYMATOUS ORGANS UNDER THE INFLUENCE OF HIGH OXYGEN PRESSURES

S. N. Yefuni et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 15–20 refs (See N70-16001 05-04)

Avail: CFSTI

A morphological study was made of the parenchymatous organs (lungs, liver, heart, kidneys) of white rats exposed to a pure oxygen atmosphere at five excess atmospheres. The rats were kept in the environment until they displayed toxic convulsions. Many of the observed disorders were similar to all the organs; vascular disturbances (hyperemia, stasis, diapedetic hemorrhages) and dystrophic processes (fatty infiltration, nuclear chromatolysis, focal necrosis). Well expressed tissue eosinophilia accompanied by eosinopenia was found in the peripheral blood. It is suggested that increased tissue eosinophilia represents a minifestation of cellular and tissue adaptation to oxygen toxicity. On the basis of the research data and information in the literature, it is concluded that animal susceptability to hyperbaric oxygen varies significantly in different individuals. Author

N70-16004# Joint Publications Research Service, Washington, D.C.

TOLERANCE OF RATS TO ACUTELY INCREASING HYPOXIA IN A HELIUM-OXYGEN ATMOSPHERE

L. A. Bryantseva et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 21–25 refs (See N70-16001 05-04)

Avail: CFSTI

Animal tolerance to rapidly increasing hypoxia in helium–oxygen and argon–oxygen environments was studied. An attempt was made to determine the mechanism underlying changes in altitude tolerance of animals. Experiments were carried out on 143 albino rats in a heat and pressure chamber. Animal tolerance to rapidly increasing hypoxia was increased in a helium-oxygen atmosphere at 21 C. This is associated with an increased cooling effect of a helium–oxygen mixture due to the higher thermal conductivity of helium in comparison with nitrogen. In an argon–oxygen environment the animal tolerance to rapidly increasing hypoxia remained unaffected in comparison with that in a sea level atmosphere. Author

N70-16005# Joint Publications Research Service, Washington, D.C.

MODELING OF CHANGES IN OXYGEN TENSION IN CEREBRAL TISSUES OF ANIMALS DURING HYPOXIC HYPOXIA

V. Sh. Berikashvili et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 26–34 refs (See N70-16001 05-04)

Avail: CFSTI

A brief description and the basic results of experiments are presented involving a smooth ascent of dogs to an altitude of 12,000 m followed by a rapid ascent to an altitude of 15,000 m in a decompression chamber. A mathematical model was formulated which adequately reproduces changes in oxygen tension in cerebral tissues of animals in response to variations in atmospheric oxygen content. The linear part of the model is a third order differential equation. The nonlinear part takes into account a marked change of pO2 in cerebral tissues during ascent of the animals to altitudes greater than 8,000 m. The model was used in studying pO2 variations during a rapid ascent of animals to simulated altitudes of 2,000, 4,000, 6,000, 8,000, 10,000, 14,000 and 16,000 m. The degree of correlation between components of the mathematical model and certain physiological structures in the animal body is discussed. Author

N70-16006# Joint Publications Research Service, Washington, D.C.

CHANGES IN "MOTIVATED BEHAVIOR" OF RABBITS DURING INCREASING HYPOXIA

G. P. Goyan et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 35–43 refs (See N70-16001 05-04)

Avail: CFSTI

Rabbits were exposed in a pressure chamber at different altitudes. The ascent rate was 25 m/sec. The animals exhibited a slight decrease in the self–stimulation reaction at about 2,000 m, followed by an increase at 3,000 to 4,000 m and a drastic decrease at 5,000 to 6,000 m. The pattern of variations in the reaction remained unaltered when the animals were given aminazin (chlorpromazine), although it developed at a lower level. Administration of scopolamine greatly inhibited the reaction beginning at altitudes of 3,000 to 4,000 m. Throughout the exposure to hypoxia up to an altitude of 6,000 m, the avoidance reaction was alleviated and arrested at an altitude of 7,000 m. Injection of scopolamine alleviated the reaction to a greater extent whereas an aminazin injection slightly reduced it, particularly at altitudes greater than 6,000 m. Author

N70-16007# Joint Publications Research Service, Washington, D.C.

EFFECT OF ALPHA-PARTICLES OF AN ISOTOPE SOURCE ON VIABILITY AND THE MUTATION PROCESS IN CHLORELLA

L. K. Vekshina et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 44–50 refs (See N70-16001 05-04)

Avail: CFSTI

Due to the small size of its cells, Chlorella is a suitable model for studying the effect of dense ionizing radiation on the living organism. Experiments revealed an exponential relationship between Chlorella survival and the dose of alpha-irradiation, a stimulating effect of low irradiation doses on cell division and changes in Chlorella mutability as a function of irradiation doses. Author

N70-16008# Joint Publications Research Service, Washington, D.C.

CHARACTERISTICS OF THE EFFECT OF HIGH-ENERGY PROTONS ON BIOLOGICAL OBJECTS

Yu. G. Grigoryev et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 51–58 refs (See N70-16001 05-04)

Avail: CFSTI

The results of radiobiological studies made over a period of many years using protons in the energy range 660 to 10 MeV are reviewed. Radiations of 180 keV X rays and Cp60 gamma rays were used as standards. Analysis of the data revealed that an exposure of animal organisms and microorganisms to high energy

protons does not result in the appearance of essentially new qualitative radiobiological effects typical only of proton radiations. However, reactions have also been recorded in which known symptoms of radiation disease develop in different quantitative proportions. Study of the quantitative characteristics of the proton effect on biological objects has indicated that the coefficients of relative biological effectiveness of protons differ insignificantly, their energy changing by more than one order of magnitude (from 650 to 50 MeVO, amounting to 1 within this energy range. The coefficients of relative biological effectiveness increase slightly if the proton energy falls below 50 MeV. This indicates that a relative biological effectiveness coefficient of 1 can be recommended for all cases of single acute exposures of animals and humans to protons in the range 660 to 50 MeV during short term space flights; this coefficient must be taken into account when designing the shielding of space vehicles. Author

N70-16009# Joint Publications Research Service, Washington, D.C.

EFFECT OF HYPOKINESIA ON CELLULAR AND HUMORAL INDICES OF ANTIBODY FORMATION IN RATS

V. G. Galaktinov et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 59–65 refs (See N70-16001 05-04)
Avail: CFSTI

The effect of hypokinesia on antibody formation in rats was studied. The number of antibody producing cells in the spleen and hemolysin titers of test animals was dependent on exposure time. For example, two and nine day exposures of rats prior to immunization resulted in an inhibition of antibody formation, that is, a decrease in cellular and humoral indices; a 45 day exposure improved the antibody producing function. A longer exposure (90 days) caused repeated inhibition of antibody production. Author

N70-16010# Joint Publications Research Service, Washington, D.C.

STUDY OF CHEMICAL MODIFICATION OF RADIATION DAMAGE OF PLANTS CAUSED BY EXPOSURE TO FAST NEUTRONS

D. M. Grodzinskiy et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 66–77 refs (See N70-16001 05-04)
Avail: CFSTI

Use of chemical substances made it possible to modify radiation damage in peas during irradiation of seeds by fast neutrons with a dose D37. Catalase, DNA hydrolysate, cysteine, kinetin in combination with heteroauxin and hydroxylamine were used as such substances. The protective effect of chemical substances was evaluated using a new formula which made it possible to determine the degree of recovery produced by the radioprotectors, taking into account their effect on the unirradiated organism. Author

N70-16013# Joint Publications Research Service, Washington, D.C.

PATTERN OF CHANGES OF ELECTROCARDIOGRAMS AND CARDIAC CONTRACTION PHASES DURING ORTHOSTATIC TESTS AFTER LONG-TERM HYPOKINESIA

B. A. Korolev *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 96–101 refs (See N70-16001 05-04)
Avail: CFSTI

A 70 day bedrest experiment was carried out on sixteen test subjects between the ages of 20 and 25 years. At different time intervals the subjects underwent a 15 minute orthostatic test at a 75 deg tilt. Their electrocardiograms were recorded, phases of systole of the left ventricle were determined and vector analysis of the ECG in the frontal plane was performed. The prolonged bedrest led to orthostatic intolerance of the test subjects which involved intolerance in an erect position, tachycardia, symptoms of ischemia in the subendo- and subepicardiac layers of the myocardium and a decrease in myocardial contractability. Vector analysis of the ECG demonstrated that ECG changes occurred due to a reduction of the blood supply to the myocardium, which when aggravated by altered coronary vessels, may bring about organic disturbances of the myocardium. Author

N70-16017# Joint Publications Research Service, Washington, D.C.

DEPENDENCE BETWEEN OXYGEN CONSUMPTION AND LUNG VENTILATION IN ORTHOSTATIC TESTS

A. D. Voskresenskiy et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 124–128 (See N70-16001 05-04)
Avail: CFSTI

A statistical analysis was made of lung ventilation and gas exchange indices during orthostatic tests on 16 healthy young males before and after an 18 hour immersion in water at a temperature of 34.5 C. Thirty six experiments were run for studying orthostatic tolerance. The tests were performed using a special table which was rotated 90 deg. Exhaled air was collected in a Douglas bag at rest and during the fifth–tenth minute of orthostasis. In the statistical analysis of the results all the subjects were divided into two groups: first, individuals for whom the tolerance to tests before and after immersion was good; second, individuals for whom symptoms of orthostatic collapse were noted in one of the preceding or current experiments. Two experimental subgroups were defined in each of the groups: (a) prior to immersion and b) after IMMERSION' The 02 utilization factor, the ratio of 02 consumption (in ml/min) to the minute volume of ventilation (in liters/min), was computed as an index of lung ventilation efficiency. Regression analysis was used for evaluating the relationship between minute volume of ventilation and gas exchange indices. Author

N70-16021# Washington Univ., Seattle. Dept. of Physiology and Biophysics.

MODIFICATION AND APPLICATION OF THE BIOTHERMAL ANALOG COMPUTER Final Report Feb. 1966–Sep. 1968

Arthur C. Brown and David L. Johnson Jun. 1969 48 p
(Contract AF 33/615/-3705)
(AD-695463; AMRL-TR-69-12) Avail: CFSTI CSCL 6/19

The present report is the third in a series on the electronic analog simulation of the human temperature regulation system. The objectives of the present work were (1) to redesign the original computer circuit to improve reliability; (2) to extend the computer capability to enable simulation of response to solar (or other point source) incident heat load; (3) to compute human survival time for a subject confronted with high heat loads and high ambient humidity. The first objective was realized by substituting electronic for mechanical elements in the computer. Equations relating body heat load to incident solar radiation were developed and the simulating circuits designed and constructed to realize the second objective. The third objective, simulation of hot, humid environments, resulted in the recommendation that exposure to high temperature (45-50C) should be limited to 0.5 hours, with progressively greater exposure time permissible at lower environmental temperatures. Author (TAB)

N70-16085*# Sandia Corp., Albuquerque, N. Mex.

CONTAMINATION CONTROL TRAINING COURSE OUTLINE

K. F. Lindell and D. M. Garst Mar. 1969 22 p refs
(NASA Order H-13245A)
(NASA-CR-107703; PB-183453; SC-M-69-127) Avail: CFSTI CSCL 18H

The course outline considers the developing need for contamination control; the types, sources, and migration of contaminants; the methods for eliminating or controlling contaminants in liquids, gases, and on surfaces; and the means for evaluating the effectiveness of these controls. It also includes a treatment of the role of people in contamination control; how they both contribute and control contaminants. Author (USGRDR)

N70-16096# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

PHOTOPIC SPECTRAL SENSITIVITY AND CHROMATIC ADAPTATION AS REVEALED BY HUMAN FLICKER-ELECTRORETINOGRAPHY

P. Padmos and D. van Norren 1969 34 p refs Submitted for publication

(IZF-1969-19; TDCK-54370) Avail: CFSTI

The human ERG response to 40 Hz stimulus was measured using a synchronous detection technique. Thus it was possible to record spectral sensitivity quickly and easily. Experiments are reported to demonstrate that only the cones contributed to the total response. Adaptation to a red background of 3.7 x 10 to the 4th power troland and a blue background of 2.2 x 10 to the 4th power troland caused selective depression of spectral sensitivity. Neither green nor white adaptation altered the spectral sensitivity. The results of parallel experiments on a protanope indicated that no change in spectral sensitivity took place during exposure to intense colored backgrounds. Measurements of the influence of chromatic adaptation were also performed using a psychophysical threshold criterion for sensitivity. The results are in close agreement with the ERG data. A study of the recovery of the response after exposure to colored backgrounds indicated that the site of chromatic adaptation is not confined to the receptors' pigments. Author

N70-16128*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

STUDY OF ANTIBODY SYNTHESIZING FUNCTION OF THE SPLEEN IN MICE IN THE EARLY POSTNATAL PERIOD [IZUCHENIYE ANTITELOSINTEZIRUYUSHCHEY FUNCTSII SELEZENOK Y MUSHEY V RANNEN POSTNATAL'NOM PERIODE]

I. N. Mayskiy et al Washington NASA Dec. 1969 4 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), v. 67, no. 3, 1969 p 68 - 70

(Contract NASw-1692)

(NASA-TT-F-12777) Avail: CFSTI CSCL 06C

The antibody-synthesizing function of the spleen of A-strain mice in the early postnatal period was studied. With the method of local hemolysis in Erne agar the authors counted cells producing antibodies in the spleens of mice immunized by sheep erythrocytes on the 3rd, 7th, 10th, 14th, 30th and 90th day of life. A significant immune reaction was seen beginning with the 7th day of life. Later the authors noted an increase in the number of antibody synthesizing cells; after a month their level was practically equal to that of the adult immune animals. A definite relationship between the antigenic differentiation of the spleens, studied during former investigations, and its antibody-synthesizing function was shown. Author

N70-16163# Navy Medical Neuropsychiatric Research Unit, San Diego, Calif.

SLEEP REQUIREMENTS OF MAN-IN-THE-SEA

Paul Naitoh, R. Townsend, and M. Greenwood Aug. 1969 43 p refs

(AD-695377; NMNRU-68-22) Avail: CFSTI CSCL 6/19

Despite recent scientific and technological gains in realizing the goal of manned underwater stations, there has been a singular lack of research data on defining the sleep requirements of man-in-the-sea. Behaviorally, sleep loss and sleep disturbances produce lapses in performance and impairment of short-term memory, wither of which may endanger the mission or the life of the entire crew of an ocean floor habitat. Interpersonal difficulties may also arise as a result of undesirable personality changes caused by sleep disturbances, thereby weakening the very root of the miniature society of the ocean floor habitat. Research efforts must be spurred on to learn: (1) whether man as an aquanaut may develop new kinds of sleep requirements which differ from those of land based man, (2) whether man may also develop serious sleep disturbances, whether we can specify the optimal physical and psychological conditions for mans recuperation from fatigue by adequate sleep in the underwater habitat. TEKTITE I, a nitrogen saturation diving experiment is used to illustrate an attempt to obtain the data necessary to define sleep requirements of man-in-the-sea. Author (TAB)

N70-16166# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

PROCESSING OF TEMPORAL INFORMATION AND THE COGNITIVE THEORY OF TIME EXPERIENCE

John A. Michon 1969 28 p refs Presented at 1st Conf. of the Intern. Soc. for the Study of Time, Oberwolfach, West Ger., 30 Aug. - 6 Sep. 1969 Submitted for publication

(IZF-1969-21; TDCK-54403) Avail: CFSTI

For man as an information processing system, time is one of the experiential dimensions of information, and it should be considered equivalent to other, non-temporal, aspects of this information, such as intensity, size, etc. Since as a processer man has a limited capacity there will be necessarily a trade-off between temporal and non-temporal information, which is open to quantification. Research in this area is reviewed. Most contemporary models of time evaluation incorporate a specific pulse counter mechanisms to account for the internal clock by which time is measured subjectively. The rate of this internal clock is thought to be influenced by the information processed by the subject. In this paper an alternative formulation is defended: time evaluation is a cognitive reconstruction of contents of the interval. The latter formulation avoids the unnecessary assumtpion of the former. It explains the same phenomena equally well, while moreover it can handle various matters that offer difficulties to models stated in terms of clock mechanisms. Author

N70-16167# Joint Publications Research Office, Washington, D.C.

ECHOLOCATION DIFFERENTIATION AND CHARACTERISTICS OF RADIATED PULSES IN DOLPHINS

E. Sh. Ayrapetyants et al 19 Dec. 1969 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 188, no. 5, 1969 p 1197 - 1199

(JPRS-49479) Avail: CFSTI

An investigation of the mechanisms of spatial orientation in dolphins was performed. The results of physiological and hydroacoustic investigations of the degree of differentiation of figures and pulses radiated in the course of echo information in the Black Sea dolphins is submitted. At the same time an attempt was made to define some of the parameters of short and long range communication in these animals. Author

N70-16313# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.

GEOCHEMICAL ECOLOGY AND EVOLUTIONARY CHANGES IN PLANTS

V. V. Kovalskii et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geocham. 1969 p 613 - 627 refs (See N70-16251 05-13)

Copyright. Avail: CFSTI

Element requirements and optimum element contents in soil and their effects on plant ecology and evolutionary adaptation processes are outlined. It is shown that acquired adaptive plant properties may become permanent even under new geochemical conditions; nonadaptive plants may display endemic diseases, stunted growth, and impairment of reproductive parts and generative functions when a deficiency of chemical elements exists in the environment. Excessive presence of needed elements produces similar effects. Adapted plants can concentrate chemical elements to different extents as a result of natural selection based on physiological variability of the plants without apparent morphological changes. Habitual concentrators may form endemic varieties. It is concluded that the following adapted concentrator forms are

possible: (1) physiological forms within the variety without morphological changes; and (2) morphologically changed varieties and endemic species connected with certain chemical elements. G.G.

N70-16314# Imperial Coll. of Science and Technology, London (England).
APPLIED GEOCHEMISTRY AND THE COMMUNITY
J. S. Webb *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 628–639 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

The role of applied geochemistry in prospecting for metalliferous mineral deposits is now firmly established. Comprehensive regional and detailed geochemical maps could well be of special value in this connection, and examples are given showing that such maps may be produced using sampling and analytical techniques already developed for purposes of mineral exploration. Although these techniques will undoubtedly need to be modified to meet the ideal requirements of chemical-ecological studies, exploration geochemistry is today yielding such tremendous reserves of samples and data that, given the necessary coordination between the different sciences involved, they could clearly have immediate application in many agricultural, epidemiological and related investigations. Author

N70-16360# Max-Planck-Institut fur Verhaltensphysiologie, Seewiesen uber Starnberg (West Germany).
INVESTIGATIONS OF THE CIRCADIAN PERIODICITY IN MEN, WITH PARTICULAR CONSIDERATION OF THE INFLUENCE OF WEAK ALTERNATING ELECTRIC FIELDS [UNTERSUCHUNGEN ZUR CIRCADIANEN PERIODIK DES MENSCHEN MIT BESONDERER BERUECKSICHTIGUNG DES EINFLUSSES SCHWACHER ELEKTRISCHER WECHSELFELDER]
R. Wever Sep. 1969 212 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Wiss. Forsch.
(BMwF-FB-W-69-31) Avail: CFSTI

In a special underground bunker, circadian rhythms of 108 human subjects were studied under complete isolation from the environment. It is shown that these rhythms are influenced, not only by light, but especially by a 10-cps electric field in a regular manner. Apart from the periodic and other rhythm parameters, the tendency towards internal desynchronization depends on the respective environmental conditions. The significance of the results obtained are discussed with regard to a hypothesis of circadian rhythms. The practical aspects of the influence of weak electromagnetic fields on human beings are proven. Author (ESRO)

N70-16373# School of Aerospace Medicine, Brooks AFB, Tex. Medical Div.
THE PURE-TONE AIR CONDUCTION AUDIOGRAM Final Report
Vernon C. Bragg Jul. 1969 19 p refs
(AD-695850; SAM-TR-69-39; SAM-REV-4-69) Avail: CFSTI CSCL 6/5

Many U. S. Air Force Flight Surgeons, medical officers, and others concerned with the conduct of hearing conservation programs have expressed the need for a set of guidelines to be used in the interpretation of audiometric data. Although the air conduction audiogram does not provide sufficient information to allow a definitive diagnosis to be made, it usually gives an indication as to whether a hearing loss is conductive or sensorineural in origin. In addition, determination may be made from the audiogram as to what further testing should be carried out and what action may be necessary to prevent further hearing loss. A method for interpretation of audiometric data is presented. An explanation of the various audiometric contours is given, followed by a step-by-step procedure for analyzing the pure-tone audiogram. In addition, recommendations are made concerning the handling of patients whose audiograms are not within normal limits. Utilization of these procedures within a comprehensive program of hearing testing, noise control, and education is recommended wherever personnel work in hazardous noise. They should also be helpful in dealing with other types of hearing losses. Author (TAB)

N70-16398*# Indiana Univ., Bloomington. Div. of Optometry.
SOME TIME FACTORS IN STEREOPSIS
R. W. Reading and George C. S. Woo Dec. 1969 35 p refs
(Contract NAS9-8224)
(NASA-CR-102108) Avail: CFSTI CSCL 06P

The effects of monocular changes in retinal illuminance, and delay time on the threshold of stereopsis was studied in three subjects making stereoscopic judgments on an experimental apparatus which is described. Responses are discussed and summarized in tables. It is concluded that measurement of stereopsis under conditions in which the monocular retinal illuminance of the test target is altered indicate that the threshold increases as a function of the dimming of a monocular image regardless of which eye receives the less bright image. F.O.S.

N70-16399*# Naval Aerospace Medical Inst., Pensacola, Fla.
CONDUCTION VELOCITY IN NERVE EXPOSED TO A HIGH MAGNETIC FIELD
Vernon R. Reno 6 Oct. 1969 18 p refs
(NASA Order ER-19841)
(NASA-CR-107729; NAMI-1089) Avail: CFSTI CSCL 06C

Action potentials were recorded at four positions from frog sciatic nerves exposed to a constant magnetic field of 11.8 kilo-oersted. External electrodes arranged in pairs on segments of nerve oriented both parallel and perpendicular to the field permitted conduction velocity measurements to be expressed as a function of field orientation. An increase in conduction velocity was observed to be orientation dependent as was a latent period in its appearance. Possible mechanisms of action of the field are discussed in terms of current theories of impulse propagation. Author

N70-16411# Joint Publications Research Service, Washington, D.C.
METHODOLOGICAL PROBLEMS OF MODELING NEURON STRUCTURES [METODOLOGICHESKIYE VOPROSY MODELIROVANIYA NEYRONYKH STRUKTUR]
N. V. Pozin 5 Dec. 1969 18 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 8, 1969 p 85–96
(JPRS-49384) Avail: CFSTI

Problems involved in modeling information processing and control functions of the nervous system are considered. Two questions of methodology are discussed: (1) whether reality is more closely approached and information processes are more faithfully represented by continuous or discrete methods, and (2) the alternatives of approach. Should the approach be one of determinism or randomness; assuming that the organization of neuron networks of any division of the brain should be treated as deterministic, yet taking into consideration the fact that frequently the prognosis of a specific neural event or at least the parameters of this event will be a random phenomenon. D.L.G.

N70-16423*# Mississippi State Univ., State College. Dept. of Microbiology.
SOME OF THE EFFECTS OF CONCENTRATED SPENT MEDIUM ON THE ACTIVITY OF RESTING CELLS OF HYDROGENOMONAS EUTROPHA
William Scott Moody (M.S. Thesis) Jan. 1970 83 p refs
(Grant NGR-25-001-004)
(NASA-CR-107727) Avail: CFSTI CSCL 06K

Experiments were performed to determine some of the effects of concentrated spent medium on the ability of resting cells

of Hydrogenomonas eutropha to utilize a hydrogen-oxygen gas mixture. Preliminary experiments showed that normal mineral salts medium, concentrated mineral salts medium, and spent medium reduced the ability of resting cells of H. eutropha to utilize a hydrogen-oxygen gas mixture. Concentrated spent medium appeared to have no effect on the gas consumption by the organism. Concentrated spent medium was found to be nontoxic to cells of H. eutropha. It was also discovered that these cells were unable to utilize concentrated spent medium as a substrate. Other experiments showed that resting cells were affected by a change in pH. Author

N70-16476 Indiana Univ., Bloomington.
EFFECTS OF HIGH-ALTITUDE ACCLIMATIZATION ON THE PERFORMANCE OF THE ISOLATED RAT VENTRICULAR STRIP
James Joseph Mc Grath (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-4779

Tissue level acclimatization to the hypoxia of high altitude was demonstrated using the isolated right ventricular strip preparation. Male, albino rats were acclimatized in a barometric chamber for 15 days. The chamber was programmed for 20 hours per day at a simulated altitude of 22,500 feet and 4 hours per day at sea level. At the end of the acclimatization period, strips of myocardium were removed from the right ventricle and immersed in a buffered Ringer's solution which was aerated with an aerobic gas mixture. The strips were stimulated electrically, and developed and resting tensions were continuously recorded. The tissue level adaptatiion investigated in these experiments is explained as an increased capacity for anaerobic glycolysis induced by chronic exposure to the hypoxia of high altitude. Evidence supporting this viewpoint is seen in the increased anoxic tolerance of the preparations in the presence of glucose as well as in the change in performance of the high-altitude preparatiions after iodacetate treatment. Dissert. Abstr.

N70-16488*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE PARTICIPATION OF MACROPHAGES AND NEUTROPHILES OF IMMUNE MICE IN PHAGOCYTOSIS OF CELLS INFECTED BY VIRUS [U CHASTIYE MAKROFAGOV I NEYTROFILOV IMMUNNYKH MYSHEY V FAGOTSITOZE ZARAZHENNYKH VIRUSAMI KLETOK]
A. A. Kyazimova et al Washington NASA Dec. 1969 6 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), v. 67, no. 9, 1969 p 70-72
(Contract NASw-1692)
(NASA-TT-F-12778) Avail: CFSTI CSCL 06C

The authors studied the participation of macrophages and neutrophiles in the cellular fragments infected by virus or vesicular stomatitis and Newcastle's disease. Macrophages and neutrophiles of the peritoneal exudate of mice were capable of seizing virus infected cellular particles. Macrophages of immune animals had an increased phagocytic activity towards the particles infected by virus which had a strictly specifical character. Author

N70-16681 Texas Univ., Austin.
THE PRESSURE DISTRIBUTION DEVELOPED WITHIN THE SKULL DURING DYNAMIC LOADING
Johnny Anthony Kopecky (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-6171

An analysis is presented of the pressure distribution developed during impace within the matter contained inside the human skull. The skull is modeled as a closed, thin elastic shell filled with a homogeneous, elastic fluid. Attention is restricted to impacts having a long duration relative to the traverse time of a stress or pressure wave. For collision with both blunt and pointed objects, parameter studies demonstrate the behavior of the pressure distribution when changes are made in fluid and shell density and elastic modulus in five different shell shapes. Negative gage pressures are found to be of larger magnitude in cases of a pointed collision surface than in blunt impacts, in frontal collision models than in side-on models, in rigid shells than in shells of less rigid materials, and in denser contents than in those less dense. Author

N70-16815 Texas Univ., Austin.
Fe-57 MOESSBAUER STUDIES OF FERRITIN AND TRANSFERRIN
James Lee Gilchrist (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-6146

Ferritin and transferrin are important in human and animal metabolism. Ferritin, an iron storage protein, is composed of a protein coat which encloses an inorganic, iron containing core, the micelle. Transferrin is an iron chelating protein which, in higher animals and man, is important in the transport of iron in blood serum. Moesbauer spectroscopy offers a sensitive way to examine the chemical environment of the Fe-57 in iron containing compounds. The micelle of ferritin was the object of Moesbauer investigation. The Moesbauer spectra of ferritin and four crystalline modifications of FeOOH indicate that the Fe-57 nucleus of these compounds interacts with a magnetic field and simultaneously with an electric field gradient tensor (efg), when these compounds are below their Neel temperature. Dissert. Abstr.

N70-16827 Ohio State Univ., Columbus.
STUDIES OF THE ADVERSE EFFECTS OF OXYGEN AT ATMOSPHERIC PRESSURE
Marjorie Frances Sparkman (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-4977

Rats were subjected to 100 per cent oxygen at atmospheric pressure. Variables affecting the response to oxygen examined were weight of rats, adrenalectomy, oral intake of NaCl or NCl solutions, and injections of aldosterone. In addition, experimentaion included in vitro incubation of adrenal tissue as well as quantitative measurements of plasma concentrations of sodium andpotassium andhematocrit values taken from rats exposed to oxygen and to room air while drinking distilled water or 0.9 per cent NaCl solution. Dissert. Abstr.

N70-16848# Florida Univ., Gainesville. Dept. of Opthalmology.
VISUAL CELLULAR STIMULATION BY HIGH QUANTA Comprehensive Report 1967-1969
William W. Dawson 1969 17 p refs
(Contract AT(40-1)-3599)
(TID-25195) Avail: CFSTI

A review of previous research by other investigators led to the conclusion that X-ray responsiveness is dependent more upon configuration aspects of neuronal organization than on the presence or absence of photopigment, and its bleach product. Objectives of present research are to determine the particular retinal layers and cellular elements whose functions are altered or activated by low dose pulses of ionizing rays to account for the fact that people can see X-rays on their product. A second goal was the application of ionizing rays to the measurement of retinal scotomata. Athird goal was to test the effectiveness of physiologically equated X-ray and visual stimuli in a simple eye. It was then proposed that findings from the above objections would be incorporated into a generalized theoretical structure which would account for visual excitation by ionizing rays and would also shed knowledge on the excitability of central nervous tissue by ionizing rays using the retina as a model tissue. Progress towards these goals consisted of development of tools for identification of those retinal cells that are excited by X-rays. NSA

N70-16876*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AVERAGE EVOKED POTENTIALS: METHODS, RESULTS, AND EVALUATIONS

Emanuel Donchin, ed. and Donald B. Lindsley, ed. (Calif. Univ., Los Angeles) Washington 1969 410 p refs Proc. of Conf. held at San Francisco, 10 – 12 Sep. 1968

(NASA-SP-191) Avail: SOD $2.00; CFSTI CSCL 06B

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13. DYNAMICS OF VERTEX EVOKED POTENTIALS: THE R-M BRAIN FUNCTION M. Clynes (Rockland State Hospital) p 363 – 374 (See N70-16889 05-04)

N70-16877*# California Univ., Los Angeles. Dept. of Psychology.

AVERAGE EVOKED POTENTIALS: ACHIEVEMENTS, FAILURES AND PROSPECTS

Donald B. Lindsley *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 1 – 43 refs (See N70-16876 05-04)

Avail: SOD $2.00; CFSTI CSCL 06B

Early investigations of the electrical activity of the brain and the development of electroencephalography (EEG) in Europe and the United States are briefly reviewed. It is emphasized that still little is known about the source, nature, and regulation of alpha and other spontaneous rhythms, and that careful attention should be paid to identifying the basic problems and goals in these areas as progress continues into the field of average evoked potentials (AEP) and other slow potential shifts. Important factors related to the locus, variability and components of the AEP are touched upon, as well as the possible source of the potentials (generators) and the condition that modify and control them (modulators and regulators). Finally, mention is made of the spatio-temporal distribution of potentials, the relationship between attention and AEP, specific and nonspecific sensory systems, and central and peripheral factors. A.C.R.

N70-16878*# Albert Einstein Coll. of Medicine, New York. Dept. of Neurology.

THE RELATIONSHIP OF BRAIN ACTIVITY TO SCALP RECORDINGS OF EVENT-RELATED POTENTIALS

Herbert G. Vaughan, Jr. *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 45 – 94 (See N70-16876 05-04)

(Grants PHS-NB-03356; PHS-MH-06723)

Avail: SOD $2.00; CFSTI CSCL 06B

Event-related potentials (ERP) are identified as the general class of potentials that display stable time relationships to a definable reference event. Five classes of ERP are treated: (1) sensory (evoked) potentials; (2) motor potentials; (3) long latency potentials related to complex psychological variables; (4) steady potential shifts; and (5) extracranial potentials. In many experimental situations, more than one class of ERP is present concurrently, and the investigator must distinguish between them in analyzing the electrophysiological correlations of specific psychological variables. Although characterization of specific ERP is aided by the temporal, spatial, and morphological features related to experimental handling of these variables, complete understanding of the effects of psychological manipulations or the descriptive aspects of the ERP has not yet been achieved. This discussion therefore represents a tentative treatment of the highly complex phenomena, including some approaches to defining the underlying brain processes and their psychological counterparts. A.C.R.

N70-16879*# Yale Univ., New Haven, Conn. School of Medicine.

CROSS-MODALITY COMPARISONS OF AVERAGED EVOKED POTENTIALS

W. R. Goff, Y. Matsumiya, T. Allison, and G. D. Goff *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 95 – 141 (See N70-16876 05-04)

(Grants PHS-MH-05286; NSF GB-5782)

Avail: SOD $2.00; CFSTI CSCL 06B

Studies of the averaged somatic-evoked response to other sensory systems were conducted, because it was felt that examination of common factors and differences between them would advance understanding of a modality. Of particular interest was identification of homologous components among modalities and differentiation between modality specific components and nonspecific components. Problems encountered in the experiments are treated in detail, including those involved with recording techniques, choice of stimulus intensity, and data analysis procedures. Use of bipolar recording is suggested, and a common noncalp reference location is indicated. Requirements for uniformity of measurement and component nomenclature are also emphasized. The problem of sources of variability in AEP's is treated, with the conclusion that this is intimately related to contamination of scalp-recorded AEP's by extracerebral generators. On the basis of homogeneity in focus and distribution between subjects, AEP components that appear to be of cerebral neurogenic origin are designated, and electrode locations for the three modalities that are likely to record them without serious distortions are suggested. A.C.R.

N70-16880*# Northwestern Univ., Evanston, Ill. Medical School.
VERY SLOW BRAIN POTENTIALS RELATING TO EXPECTANCY: THE CNV
Jerome Cohen *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 143-198 (See N70-16876 05-04)
Avail: SOD $2.00; CFSTI CSCL 06B

Studies into the contingent negative variation (CNV) are reviewed, with emphasis on steady cortical potentials, occasionally referred to as dc shifts or very slow potential changes. Phenomena with a latency of 200 to 300 milliseconds and a duration of 0.5 second or more are included. Research reveals that CNV develops in human subjects as the electrical response of the brain to a conditional signal that an operant response is to be made after a delay. A wide variety of stimulus and response paradigms result in the CNV, even when verbal or ideational responses are made instead of overt motor acts. The CNV varies in amplitude, shape, latency, consistency, and distribution over the head in different subjects. Evidence that eye movements do not account for the CNV is conclusive, it is similar when recorded from surface or intracranial electrodes, has a different spatial distribution than the eye field; and has been reported in a subject with eye glasses when no electrooculer field was present. Finally, mention is made of the generator for motor potential as another possible internal brain source for the CNV. A.C.R.

N70-16881*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DATA ANALYSIS TECHNIQUES IN AVERAGE EVOKED POTENTIAL RESEARCH
Emanuel Donchin *In its* Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 199-236 (See N70-16876 05-04)
Avail: SOD $2.00; CFSTI CSCL 06B

The two data analysis techniques used most often in AEP research, based on direct measurement from X-Y plots, are identified as: (1) visual inspection of the AEP records to detect similarities and differences; and (2) measurement of peak-to-peak amplitudes and latencies of various evoked response components. Drawbacks inherent in using visual inspection as an analysis technique are treated, and the advantages of having the necessary information made directly available from a computer are indicated. It is further suggested that cost factors indicate that most laboratories will be equipped with general-purpose computers, in place of special-purpose averagers, in the near future, and that these will allow extremely detailed analysis of AEP data matrices. In this connection, specific problems encountered in applying statistical analysis to such matrices are reviewed and some recently proposed techniques described. A.C.R.

N70-16882*# Columbia Univ., New York. Dept. of Psychiatry.
THE SPECIFICATION OF PSYCHOLOGICAL VARIABLES IN AN AVERAGE EVOKED POTENTIAL EXPERIMENT
Samuel Sutton *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 237-297 (See N70-16872 05-04)
(Grants NGR-33-157; PHS-MH-14580)
Avail: SOD $2.00; CFSTI CSCL 06B

Some problems in the psychological domain of particular relevance to evoked potential experiments that have been completed or are presently in progress are outlined. The importance of obtaining data in the same set of trials for all three domains - those in the area of stimuli and physiology as well as the psychological factors - is emphasized. An example of contributions made by this approach to interpreting uncertainty experiments is given, and problems that arise in attempts to compare psychological and physiological data are treated. Additional difficulties encountered by the requirement to repeat stimuli in the averaging method are also mentioned. It is suggested that the spatial averaging which is a byproduct of scalp recording makes it highly desirable that the behavioral design of experiments be as simple as possible. Finally, the need for a more systematic approach to specifying and defining the terms and constructs involved in reporting evoked potential correlates is stressed. A.C.R.

N70-16883*# Langley Porter Neuropsychiatric Inst., San Francisco, Calif.
DIAGNOSTIC USES OF THE AVERAGE EVOKED POTENTIAL
Enoch Callaway *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 299-332 (See N70-16876 05-04)
(Contract Nonr-2931(00))
Avail: SOD $2.00; CFSTI CSCL 06B

The technical feasibility of diagnostic procedures based on averated evoked potential (AEP) is discussed, and it is emphasized that such methods are primarily useful in cases where verbal communication is not possible or practical. Three such situations are identified: (1) When neurological factors, such as lesions or lack of maturity, block verbal exchange. (2) When psychological factors, such as cultural difference or mendacity, interfere. (3) When the state being tested is not accessible to introspective report, and its behavioral consequences are most inexpensively tapped by evoked potential measures. Specific application of AEP methods to sensory, neurological disease, and intelligence testing is treated, as well as usefulness in psychiatric diagnosis. It is concluded that except for diagnosis of deafness in infants, AEP still remains primarily a research technique, although promise of its clinical utility is increasing steadily. A.C.R.

N70-16884*# California Univ., Los Angeles. Space Biology Lab.
DIFFERENCES BETWEEN HUMAN EVOKED POTENTIALS ELICITED BY THE SAME ACOUSTICAL STIMULI DURING LOUDNESS DISCRIMINATION TASKS AND PITCH DISCRIMINATION TASKS
Martin F. Gardiner and Donald O. Walter *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 335-342 (See N70-16876 05-04)
(Contracts DADA17-67-C-7124; Nonr-233(91); Grants PHS-NB-02501; PHS-G-5-T1-MH-8415)
Avail: SOD $2.00; CFSTI CSCL 06B

Results regarding waveshape changes for occipital visual evoked response (VER) are reported for situations requiring the subject to discriminate between variations in the luminance of a spot. The scalp-averaged occipital VER for nine human subjects was obtained using a computer of average transients. Visual stimuli of low intensity were used. During luminance discrimination, a reduction of the first positive wave and the appearance of a secondary negative peak were observed. Author

N70-16885*# Instituto de Neurofisiologia, Montevideo (Uraguay). Lab. de Neurofisiologia.
CHANGES OF OCCIPITAL EVOKED RESPONSE DURING LUMINANCE DISCRIMINATION IN MAN
Elio Garcia-Austt, Washington Buno, Jr., and Pablo Handler *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 343-348 (See N70-16876 05-04)
(Grant NIH NB-04382-05)
Avail: SOD $2.00; CFSTI CSCL 06B

Results of a statistical study to compare human auditory evoked potentials (AEP's) recorded during two tasks, each of which focussed the subjects' attention on a different property of physically similar stimuli, are reported. The stimulus intensity and stimulus pitch were presented from the same randomized presentation schedules during both studies, and with equal presentation probabilities for all four stimuli in each schedule. The most consistent differences in evoked potentials were found in experiments where

both efforts were difficult; they appeared most reliably at delays of 200 to 500 msec after stimulus presentation, in the latency range preceding the motor acts used for reporting the required decisions. They could not, however, be accounted for by potentials time-locked to the response acts themselves. Furthermore, the differences appeared in data that were averaged among subjects and across sessions. It is suggested that the differences recorded during loudness discrimination tests and those recorded from the same stimuli during pitch discriminations tests may hold clues to task-related variations in late steps of underlying physiological mechanisms, by which the stimuli are evaluated and the required decisions made. Author

N70-16886*# California Univ., San Diego. Dept. of Neurosciences.
THE CNV AND THE VERTEX EVOKED POTENTIAL DURING SIGNAL DETECTION: A PRELIMINARY REPORT
Steven A. Hillyard *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 349-353 (See N70-16876 05-04)
Avail: SOD $2.00; CFSTI CSCL 06B

Signal detection procedures were used to show that trial-to-trial fluctuations in contingent negative variation (CNV) amplitude are correlated with the correctness of observer's responses and therefore, with his sensitivity. Computer-averaged CNV's and evoked potentials were plotted from 10 trials of four possible types for each observer. The averaged CNV amplitude was larger on those trials where signals were detected correctly (yes/signal) than when the signals were missed (no/signal). The waveshape of the CNV following the signal also depended upon the stimulus-response outcome. An electrophysiological correlate of signal detection, more striking than the CNV, was a long-latency positive wave (labelled P300) in the potential evoked at the vertex by the signal. The findings support the contention that CNV's can appear during purely sensory tasks, as well as in preparation for motor activity. It is emphasized that the results are preliminary, and further study into the CNV and P300 behavior phenomena is recommended. A.C.R.

N70-16887*# California Univ., Los Angeles. Dept. of Psychiatry.
A NOTE ON THE AEP OF AUTISTIC CHILDREN RECORDED DURING SLEEP
Edward M. Ornitz *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 355-356 (See N70-16876 05-04)
Avail: SOD $2.00; CFSTI CSCL 06B

Average auditory-evoked responses (AER's) were measured at the vertex in age-matched groups of normal and autistic children during Stage 2 and REM sleep and during the ocular quiescent phase and eye-movement burst phase of REM sleep. Results of the study suggested that the perceptual inconstancy or variability found in schizophrenia may be related to defective inhibitory mechanisms, possibly involving central vestibular function. Other indications of the validity of the conclusion are currently being sought. A.C.R.

N70-16888*# Rockland State Hospital, Orangeburg, N.Y. Research Center.
AN EXAMINATION OF EVOKED POTENTIALS AS INDICATORS OF INFORMATION PROCESSING IN NORMAL AND SCHIZOPHRENIC SUBJECTS
Kenneth Lifshitz *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 357-362 (See N70-16876 05-04)
(Grants PHS-MH-07292; PHS-FR-05561; PHS-FR-00268; PHS-MH-14934)
Avail: SOD $2.00; CFSTI CSCL 06B

Studies were conducted on schizophrenic and control subjects in an attempt to identify those characteristics representing the individual informational elements from the evoked potentials to stimuli containing multiple elements. It was felt that isolation of these characteristics might give insight into the nature of brain information processing and, additionally, identify processing abnormalities. Preliminary results are given, and a brief evaluation of the findings in relation to previous research is included. A.C.R.

N70-16889*# Rockland State Hospital, Orangeburg, N.Y. Research Center.
DYNAMICS OF VERTEX EVOKED POTENTIALS: THE RM BRAIN FUNCTION
Manfred Clynes *In* NASA. Ames Res. Center Average Evoked Potentials: Methods, Results, and Evaluations 1969 p 383-374 (See N70-16876 05-04)
Avail: SOD $2.00; CFSTI CSCL 06B

The dynamics of vertex evoked potentials were studied with primary emphasis on testing the ability of the central nervous system to differentiate between states of sensory rest and motion. Evidence is provided that the nonspecific, vertex evoked potentials function in a manner based on rein control which allows the organism to distinguish between a state of motion and one of rest for various sensory variables. This response occurs predominantly when a sensory variable leaves the state of rest and enters the state of motion; this is defined as the rest-motion (R-M) function. Once in the state of motion, further changes within this state do not generally elicit another R-M reaction. The R-M function is non-linear and may be represented dynamically by two unidirectional rate-sensitive channels added in a full wave rectification manner, followed by a low level saturating element that triggers the response through another differentiation and rectification. Author

05 BIOTECHNOLOGY

Includes life support systems; human engineering; protective clothing and equipment; crew training and evaluation and piloting. For related information see also: 04 Biosciences.

N70-15546# Dunlap and Associates, Inc., Santa Monica, Calif.
HUMAN OPERATOR MODELS FOR MANUAL CONTROL
Charles R. Kelley 1968 35 p refs
(Contract Nonr-4986(00))
(AD-694509) Avail: CFSTI CSCL 5/8

Four functions of human operator models for manual control are delineated, and criteria appropriate to models designed to better our understanding of man are developed. Five classes of models are reviewed. Criticisms of models which apply techniques of description developed in automatic control to the human operator are criticised. Models which endeavor to include the operators internal processes of prediction, planning, and adaptation appear to provide veridical representation of the human operator. Author (TAB)

N70-15632# Stanford Univ., Calif. Dept. of Computer Science.
DIALOGUES BETWEEN HUMANS AND AN ARTIFICIAL BELIEF SYSTEM
Kenneth Mark Colby and David Canfield Smith Sep. 1969 31 p refs
(Grant PHS-MH-066-45,07; Contract ARPA-SD-183)
(AD-694972; MEMO-AI-97) Avail: CFSTI CSCL 6/4

An artificial belief system capable of conducting dialogues with humans has been constructed. It intakes whatever information it receives, answers questions and establishes the credibility of the information as well as of its human source. It is currently being used to study the problem of change and resistance to change in a belief system. Author (TAB)

N70-15645# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ON THE COMPUTATION OF ARTIFICIAL GRAVITATION FOR INHABITED SPACE CRAFT COMPARTMENTS
A. M. Genin 1969 4 p refs Transl. into ENGLISH from Kosmich. Issled., (Russian), v. 7, no. 5, 1969 p 797–799
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The most natural and reliable means of protecting spacecraft crews from the adverse effects of weightlessness is by rotating the spacecraft about a center of mass at a distance from the inhabited compartments. Selecting the disorientation in coordination of motor acts as the criterion, it was determined that an artificial weight equal to 0.3 earth is sufficient for unimpeded movements of astronauts within the craft and for performance of required operations. It is shown that the onset of vestibular disorientation is dependent on the radius of rotation and angular velocity of the craft. Vestibular effects can be reduced by increasing the radius of rotation. R.B.

N70-15667# Stanford Research Inst., Menlo Park, Calif. Information Sciences Lab.
PROMENADE: AN IMPROVED INTERACTIVE-GRAPHICS MAN/MACHINE SYSTEM FOR PATTERN RECOGNITION. APPENDIX 9e: THE PUTGET VIRTUAL-MEMORY FILE-HANDLING SYSTEM
Thomas Humphrey and David Hall Nov. 1968 62 p refs
(Contract F30602-67-C-0351)
(AD-694115; RADC-TR-68-572-App-9e) Avail: CFSTI CSCL 6/4

The PUTGET system performs two important functions. It allows access to the disk via FORTRAN statements without need for programmer knowledge of lower-level disk I/O software or of the actual file formatting on the disk itself. It acts as a virtual-core memory system, so that the user is not responsible for allocation of either core buffer or disk file space. Frequently used disk records are maintained in the core memory so that they are generally available at core access rates rather than disk access rates. The efficiency with which PUTGET can perform this type of operation depends somewhat on the data structure; it works best for sequential access to contiguous files. Author (TAB)

N70-15756*# Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
CARBON DIOXIDE REDUCTION CONTRACTORS IN SPACE VEHICLES AND OTHER ENCLOSED STRUCTURES
T. Takahashi and L. T. Fan 20 Jan. 1969 28 p refs
(Grant NGR-17-001-034; Contract F44620-68-C-0020)
(NASA-CR-107699; AD-688240; AFOSR-69-1298TR; Rept-11)
Avail: CFSTI CSCL 06K

Processes for the removal of carbon dioxide from gas mixtures have been sufficiently developed in the chemical industry. In aerospace application, however, uses of many of the techniques are restricted severely by weight, power, and volume of the process units and other characteristics of the processes. In addition the processes must be operated in the zero gravitational field. The research is an evaluation of a multistage centrifugal contactor which seems promising for use in life support systems. Author (TAB)

N70-15797*# Pittsburgh Univ., Pa. Knowledge Availability Systems Center.
THE SPACE AND TECHNOLOGY TRANSFER PROGRAM Quarterly Report, Sep. – Nov. 1969
Allen Kent Nov. 1969 76 p
(Contract NSR-39-011-106)
(NASA-CR-107657; QR-3) Avail: CFSTI CSCL 05C

A description of the University of Pittsburgh Knowledge Availability Systems Center as a Regional Dissemination Center and its activities in the transfer of aerospace technology to the non-aerospace sector of the Nation's industry is presented. The report describes: (1) a summary of marketing activities, the net industrial income, plans and objectives, tools of marketing, and the resulting clientele, (2) the services provided and the quantitative units of service, and (3) strategy preparation for computer searches, manual searches, review of search output, impact studies, and aids to marketing. Author

N70-16012# Joint Publications Research Service, Washington, D.C.
DEVELOPMENT OF AUTOMATIC SYSTEMS FOR CONTINUOUS MEDICAL MONITORING IN MANNED SPACE FLIGHTS
L. M. Komarova et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 88–95 refs (See N70-16001 05-04)
Avail: CFSTI

Automatic systems for continuous medical monitoring must be introduced on manned space vehicles; the problems involved in using such systems are discussed. Selection of the parameters to be monitored, logic of diagnosing dangerous conditions, noise immunity and system reliability are discussed. A system for continuous medical monitoring developed for long term simulation experiments is described as an illustration. Author

N70-16482# Washington Univ., St. Louis, Mo. Dept. of Systems Mechanical and Aerospace Engineering.
DESIGN OF A LEARNING MACHINE AND THE STUDY OF SOME OF ITS CONVERGENCE CHARACTERISTICS
Robert Gordon Bellaire (Ph.D. Thesis) 18 Sep. 1969 148 p refs
(Contract AF-AFOSR-1422-68)
(AD-694094; AFOSR-69-2430TR) Avail: CFSTI CSCL 9/2

Whenever the dynamics and environment of a process are unknown or very complex, there is a need for learning machines capable of learning the optimal decision algorithm from experience. This dissertation proposes such a learning machine. The basic learning situation is specified by a set of six postulates and the machine MAXINE is developed to learn in this situation. MAXINE is designed to have some of the qualities of human decision making: while being able to change its mind in the face of new evidence, it is reluctant to alter firmly held opinions. The learning ability of this machine is tested by placing it in situations of varying degrees of complexity, including those which are deterministic and stochastic. Convergence of the proposed learning algorithm for the deterministic case is proved. Author (TAB)

N70-16705*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
RESEARCH ON NEW TECHNIQUES FOR THE ANALYSIS OF MANUAL CONTROL SYSTEMS Progress Report, 15 Dec. 1968 – 15 Jun. 1969
George A. Bekey, Michael J. Merritt, and Anil V. Phatak Jun. 1969 25 p refs
(Grant NGR-05-018-022)
(NASA-CR-107748; PR-8) Avail: CFSTI CSCL 05H

Continuing work in decision processes of human manual controllers, and the human neuromuscular system are reported. A method using multidimensional elements for modeling human decisions is described in terms of smoothing algorithms and applications. Abstracts of publications in stochastic approximation, manual adaptive control, and discrete human control models are included. F.O.S.

N70-16830*# Honeywell, Inc., Lexington, Mass. Honeywell Radiation Center.
DESIGN OF THE ADVANCED REMOTE OCULOMETER
John Merchant and Ronald Wislon Sep. 1969 141 p refs
(Contract NAS12-531)
(NASA-CR-86309) Avail: CFSTI CSCL 06B

The oculometer measures eye direction without attachment

to the subject, without causing interference to the subject, at distances up to several feet from the subject. The development of the oculometer provides a means of accurately monitoring eye fixations, and is also a possible new means of human control and eye control. With eye control, the subject performs a pointing or tracking task by eye, instead of by manual control. A design is presented of the optomechanical part of a remote oculometer intended for laboratory or simulator use, and capable of being easily developed (by careful packaging design) into a flight unit which would fit into the space normally occupied by a standard 3-inch instrument panel. Experimental work was performed to provide optical design information. Author

N70-16852# Texas Univ., Austin. Electronics Research Center.
QRS DISCRIMINATION FROM NOISY ELECTROCARDIOGRAMS
Carl A. Braun, Carl W. Van Ryswyk, and Fred B. Vogt 9 Sep. 1969 10 p refs
(Contract AF-AFOSR-766-67)
(AD-694125; AFOSR-69-2349TR) CSCL 6/16 Avail: CFSTI

It is the purpose of this paper to present an evaluation of a method of QRS discrimination by defining the accuracy in terms of variation of time error. Indication of reliability of detection may be determined by observing the number of false detections and missed beats. Time error in noisy electrocardiograms is determined by adding noise electronically to an essentially noise-free electrocardiogram which serves as reference for timing of events. The results indicate that electrical activity of the heart may be detected visually under noise-free conditions with an accuracy approximating plus or minus 1 millisecond. With the addition of excessive noise, time variance in the order of 15 milliseconds is observed. False recognitions and missed beats also occur. Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-15522*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
NATURAL GAS AND METHANE
D. B. Mann and W. J. Hall 1 Jul. 1969 28 p refs
(NASA Order W-12893; NBS Proj. 27506-2750454)
(NASA-CR-107617; NBS-9733) Avail: CFSTI CSCL 07C

The terms methane and natural gas cannot be used interchangeably. Analysis of available data shows that the variation in constituents of natural gas is significant and must be considered when projecting wide spread use of this energy source in liquefied form. Spectrographic data for natural gas mixtures analyzed for hydrogen, helium, methane, nitrogen, ethane, oxygen, hydrogen sulfide, argon, carbon dioxide, propane, n-butane, isobutane, n-pentane, isopentane, cyclopentane, and hexanes are grouped as to sample source. Maximum and minimum variations in constituents are presented to show the broad range of mixtures possible in the natural gas. Author

N70-15530# Boeing Scientific Research Labs., Seattle, Wash.
ULTRASONIC MEASUREMENTS IN MnF SUB 2 NEAR THE NEEL TEMPERATURE
R. G. Leisure and R. W. Moss Aug. 1969 26 p refs
(AD-695494; D1-82-0902) Avail: CFSTI CSCL 20/12

The ultrasonic velocity has been measured for both longitudinal and transverse waves in the (110) and (001) directions in MnF2 near the critical point. A sharp minimum was observed for longitudinal waves. This minimum coincided with an attenuation maximum and occurred at the Neel temperature. The velocity anomaly was frequency independent for the two frequencies used. No effect was observed for transverse waves. The attenuation was measured over a wide temperature range. The temperature dependence of both critical attenuation and velocity is given by (T-T sub N) to -0.33 power for T greater than T sub N, where T sub N is the Neel temperature of 67.34K. Author (TAB)

N70-15538# Technische Hochschule Munchen (West Germany).
INTERPRETATION OF THE THERMODYNAMIC AND KINETIC BEHAVIOR DURING SOLVENT INDUCED COOPERATIVE HELIX 1 TO HELIX 2 CONVERSION OF POLY-L-PROLINE [DEUTUNG DES THERMODYNAMISCHEN UND KINETISCHEN VERHALTENS DER LOESUNGSMITTEL INDUZIERTEN, KOOPERATIVEN HELIX 1 - HELIX 2 UMWANDLUNG VON POLY-L-PROLIN]
Dieter Winklmair (Ph.D. Thesis) 1969 110 p refs In GERMAN
Avail: CFSTI

Experimental results and statistic-thermodynamic theories based on the linear Ising model show that helix conversion provides a model for biological changes between ordered phases subject to solvent conditions by approximating phenomena through next neighbor interaction. The cooperative helix 1 = helix 11 conversion of poly-L-proline takes place between two ordered phases and represents the type of conformation transfer found in many enzymes. Poly-L-proline is a linear chain of proline radicals linked by peptide bonds. The molecule forms a right slanted helix when all radicals are bound to peptides in cis-formation, and a left slanted helix if they are bound in trans-formation. A change in solution composition effects the thermodynamic equilibrium and induces conversion. The seed formation parameter that determines the thermodynamic probability of a nucleus of one formation in the sequence of the other formation is practically independent from solvent composition and represents a high amount of free energies. The average length of an uninterrupted formation sequence is longer than the effective distance of electrostatic repulsion between charged oxygen atoms in the CO group which is mainly responsible for cooperation. Transl. by G.G.

N70-15563*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO 11 EVIDENCE FOR THE DIFFERENTIATION OF LUNAR MATERIALS
Robert F. Mueller Dec. 1969 20 p refs
(NASA-TM-X-63791; X-644-69-538) Avail: CFSTI CSCL 07D

Preliminary analyses of lunar rocks are compared with the compositions of terrestrial rocks and meteorites and some interpretations are attempted in terms of chemical theory. Theories are advanced to explain differentiation of the origin of the moon with respect to certain gases and more refractory elements. Preliminary studies indicate that the surface features of the moon, including the circular maria, owe their existence to impact explosions of solid bodies varying in kinetic energy. It is theorized that the lunar deposits have been strewn and restrewn across the surface and that they have been disturbed to depths of the order of many kilometers. The Tranquility base surface rock compositions appear to be consistent with a differentiation mechanism, perhaps of a complex character embodying igneous and other processes, but which probably contained elements similar to that which produced Earth's crust. However, there are important modifications induced particularly by the low water content of the lunar rocks. R.B.

N70-15618# Arizona Univ., Tucson. Dept. of Chemistry.
CHEMISTRY OF ORGANOLITHIUM COMPOUNDS AND ACETYLENES Final Scientific Report, 1 Nov. 1964 - 30 Oct. 1968
James E. Mulvaney 19 Sep. 1969 6 p refs
(Grants AF-AFOSR-720-65; AF-AFOSR-720-67)
(AD-694076; AFOSR-69-2398TR) Avail: CFSTI CSCL 7/3

A brief summary of the research is presented. Primary organolithium compounds react with diphenylacetylene to produce an addition-metalation product. Depending upon conditions tertiary organolithium compounds give addition-metalation or products of electron transfer. Using methylphenylacetylenes and organolithium compounds one obtains a trimetalated product. N,N,N,N-Tetramethylethylene diamine has a large accelerating effect on the rate of these reactions. Lithium metal, as initiator, has been found to give unusual copolymer compositions with acrylophenones and styrenes. The significance of these results are discussed. Author (TAB)

N70-15639*# Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
SEVERAL DIFFERENT GAS-LIQUID CONTACTORS UTILIZING CENTRIFUGAL FORCE
T. Takahashi and L. T. Fan 19 Dec. 1968 43 p refs
(Grant NGR-17-001-034; Contract F44620-68-C-0020)
(NASA-CR-107685; AD-688239; AFOSR-69-1297TR; Rept-10) Avail: CFSTI CSCL 07A

Various types of contactors utilizing centrifugal force (centrifugal contactors) have been used commercially especially in the chemical industry for production of petro chemicals, organics, and pharmaceuticals, for refining petroleum, and for other purposes. The centrifugal contactors have been known to have characteristics of high efficiency, large gas and liquid through-put, small liquid holdup, and short contact time. This research is an evaluation of several types of centrifugal contactors. Author (TAB)

N70-15644*# National Bureau of Standards, Washington, D.C.
ELECTROCHEMICAL DATA. PART 12: ELECTROLYTIC CONDUCTIVITY OF AQUEOUS SOLUTIONS OF THE SODIUM HALIDES
Harold J. De Wane and Walter J. Hamer 15 Jan. 1969 22 p refs
(NASA Order R-09-022-029)
(NASA-CR-107612; NBS-9979) Avail: CFSTI CSCL 07D

This report gives a critical evaluation of the available data on the electrolytic conductivity of aqueous solutions of sodium chloride at 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 and 55 C, of sodium iodide at 0, 25, 29.92 and 49.3 C, and of sodium bromide and fluoride at 25 C. Author

N70-15664# State Univ. of New York at Buffalo. Dept. of Chemistry.
PHOTOCHEMICAL GENERATION OF DIVALENT CARBON DERIVATIVES Final Report, 1 Feb. 1965 – 31 Aug. 1969
Albert Padwa 19 Sep. 1969 8 p refs
(Grants AF-AFOSR-820-65; AF-AFOSR-1213-67)
(AD-694098; AFOSR-69-2372TR) Avail: CFSTI CSCL 7/5

A brief review of the authors research is presented. Part of the investigation studied the chemical response to ultraviolet radiation of several small ring heterocyclic systems. The phototransformations of beta, gamma-epoxy ketones, dibenzoylstilbene episulfides, arylaroylazetidines, cyclopentyl phenyl ketone, and alpha-diazdecetophenone were examined in mechanistic detail. Photosensitization, quenching, and emission studies were performed in order to describe the excited states involved in these photoreactions as well as to provide for a better understanding of the mechanism of these transformations. Author (TAB)

N70-15670# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Lab.
EXPERIMENTAL MEASUREMENTS OF SHORT SPIN RELAXATION TIMES: HIGH TEMPERATURE RELAXATION PROCESSES OF Fe AND MgO
Jefferson S. Bennett Aug. 1969 134 p refs
(AD-695620; RR-TR-69-13) Avail: CFSTI CSCL 20/12

The spin-lattice relaxation time, T(1), for the ground state Kramers doublet of Fe(+) in MgO has been measured by pulse saturation in a fast TWT (traveling wave tube) x-band spectrometer. All the data from 10 to 23K are accurately described by an equation. From 1.2 to about 10K, the relaxation time is angular dependent and there is evidence for cross relaxation. The microwave absorption line is inhomogeneously broadened at 4.2K and is nearly Lorentzian at all temperatures. The observed line width has a relaxation induced component whose temperature dependence from 23.2 to 37K with H is accurately described. Bloche equations give the ratio T(1)/T(2) 0.73. These measurements establish the existence of sharp electronic levels at about 150/cm and 310/cm above the ground state Kramers doublet on the basis of relaxation via two Orbach processes. The energy level separation is in partial agreement with the predictions of a point charge model of cubic MgO. The large reduction of octahedral crystal field parameters indicated by the experimental results is discussed. Author (TAB)

N70-15675# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
GAS CHROMATOGRAPHIC DETERMINATION OF ETHYLENE GLYCOL IN USED OILS Final Report
George G. Esposito and Robert G. Jamison Sep. 1969 15 p refs
(AD-694360; CCL-270) Avail: CFSTI CSCL 7/4

Reduced performance and sometimes complete failure of internal combustion engines can be, at times, attributed to contamination of crankcase oil by the presence of glycol antifreeze. In the course of testing used crankcase oils, it is advantageous to be able to detect the presence of glycol and determine its concentration. This report describes a rapid new analytical procedure for the determination of ethylene glycol in crankcase oil using programmed temperature gas chromatography. The procedure involves the conversion of ethylene glycol to its trimethylsilyl derivative prior to chromatographing; identification and determination is obtained from the time incident and magnitude of the ethylene glycol peak appearing on the chromatogram. Author (TAB)

N70-15683# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
BIBLIOGRAPHY OF ION-MOLECULE REACTION RATE DATA
George A. Sinnott (Colo. Univ.) 15 Aug. 1969 73 p refs
(Contract DA-31-124-ARO(D)-139)
(AD-695892; JILA-9; AROD-4445-144-P) Avail: CFSTI CSCL 7/4

The bibliography extends the JILA Information Center coverage of low energy atomic collision phenomena to include ion-molecule reaction rate data. The bibliography was compiled by a search of the open, published literature for those papers that contain original experimental data on ion-molecule reaction cross sections or rate constants. In particular, the processes searched for were: positive and negative ions either charge exchanging or heavy particle exchanging with neutral molecules or atoms, excited neutrals reacting with neutrals to create ionized species, and ion-ion reactions. Author (TAB)

N70-15708# Brandeis Univ., Waltham, Mass. Dept. of Chemistry
PRIMARY PROCESSES IN THE PHOTOCHEMISTRY OF AZO AND RELATED COMPOUNDS AND STUDIES IN UNIMOLECULAR REACTIONS Final Report, 1 Jan. 1964 – 31 Dec. 1967
Colin Steel 7 Aug. 1969 26 p refs
(Grants AF-AFOSR-583-64; AF-AFOSR-583-66)
(AD-694107; AFOSR-69-2424TR) Avail: CFSTI CSCL 7/5

A summary is given of work involving unimolecular reactions of vibrationally excited bicyclopentane produced from the photolysis of 2,3-diazabicyclo(2.2.1)hept-2-ene were studied. The primary

processes in the photochemistry of 2,3-diazabicyclo(2.2.2)oct-2-ene and 2,3-diazabicyclo(2.2.1)hept-2-ene were also investigated. The photodecomposition of azoisopropane-oxygen mixtures resulted in new mechanisms for oxidation of isopropyl radicals. Author (TAB)

N70-15727 National Lending Library for Science and Technology, Boston Spa (England).
CRYSTALLISATION OF SOLID SOLUTIONS OF InAs(1-x)P(x) FROM THE GAS PHASE
L. A. Egorov et al 28 Jul. 1969 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan. Materialy (Moscow), v. 5, 1969 p 173–174
(NLL-RRE-Trans-240-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Furnace zone temperatures were used to grow single crystals of InAs-InP solid solutions to determine their transfer rate. The transfer rate of the InAs-InP system was found to reduce almost linearly with the increase of InP. Other results show that with constant temperature gradients, the diffusion rate reduces with the increase of pressure. Graphical results are given for an X-ray analysis by the inverse photography method on copper radiation. J.M.C.

N70-15729*# Worcester Polytechnic Inst., Mass. Dept. of Chemical Engineering.
STUDY OF THE TECHNIQUES FEASIBLE FOR FOOD SYNTHESIS ABOARD A SPACECRAFT Semiannual Status Report, 1 Aug. 1968–31 Jan. 1969
Alvin H. Weiss 1 Mar. 1969 53 p refs
(Grant NGR-22-017-008)
(NASA-CR-107651; SASR-2) Avail: CFSTI CSCL 07C

Studies conducted in a continuous stirred tank reactor have for the first time, produced quantitative results on the kinetics of the formose reaction and associated Cannizzaro effects. Of major significance is the fact that the observed inductive and zero order nature of the kinetics of the formose reaction can be explained by deriving rate expressions which have direct analogs in heterogeneously catalyzed systems. Here complexing-decomplexing steps in the formose system directly correlate with adsorption-desorption steps in heterogeneous systems. The controlling nature of product decomplexing in the formose system produces the observed kinetic behavior. Author

N70-15734# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.
KINETICS OF AUTOXIDATION OF ISOTACTIC POLYBUTENE-1 BY INFRARED SPECTROSCOPY
S. S. Stivala, G. Yo, and Leo Reich (Picatinny Arsenal) 9 Sep. 1969 17 p refs
(Contract N00014-68-A-0131)
(AD-694532; ONR-TR-12) Avail: CFSTI CSCL 7/3

The autoxidation of a film of isotactic polybutene-1 (IPB) containing a large amount of metallic ash (about 0.2%) was studied by means of infrared spectroscopy. Reaction temperatures were varied from 105 to 120C and oxygen concentrations from 25 to 100% by volume. A reaction scheme previously reported for the autoxidation of atactic polybutene-1 (APB) was utilized for the IPB. Various results obtained for IPB were compared with those previously reported for APB. Author (TAB)

N70-15736 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.
COMPLEXOMETRIC TITRATION (CHELATOMETRY). PART 8: THE MASKING OF CATIONS USING 2,3 DIMERCAPTOPROPANOL
R. Pribil et al Jun. 1969 19 p Transl. into ENGLISH from Collection of Czech. Chem. Commun. (Prague), v. 19 1954 p 1162–1170 In CZECHOSLOVAKIAN and ENGLISH
(NLL-Trans-746-183-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL Photocopy Coupons

An alcoholic solution of 2,3-dimercaptopropanol was used for masking certain cations, for example, lead, bismuth, zinc, mercury, etc. Undissociated salts form which are soluble in ammonia with formation of colorless or only weakly colored solutions. A number of new complexometric determinations becomes possible, for example, of calcium and magnesium, even in the absence of lead and bismuth. The different reactivity of various complexonates with respect to 2,3-dimercaptopropanol was used for gradual determination of cations in their mixtures, as, for example, lead in the presence of manganese, zinc in the presence of nickel etc. The corresponding combination or gradual addition of further complex-forming substances (potassium cyanide and triethanolamine) or, finally, selective precipitation (sodium diethyldithiocarbamate) permit gradual determination of 4 to 5 cations. Examples are given for determining lead; cobalt and manganese; nickel zinc, and magnesium; and lead, zinc, nickel, magnesium, and calcium in the presence of iron and aluminum. Author

N70-15748# Florida Univ., Gainesville. Dept. of Chemistry.
DENSITY MATRIX APPROACH TO QUANTUM CHEMISTRY Final Scientific Report
Darwin W. Smith 15 Aug. 1969 10 p refs
(Grant AF-AFOSR-1544-68)
(AD-694082; AFOSR-69-2057TR) Avail: CFSTI CSCL 7/4

This report is a very brief general survey of three areas in which density matrix methods are used in research on the electronic structure of atoms and molecules: Analysis of wavefunctions; construction of better wavefunctions; and attempts to bypass the wavefunction by studying the N-representability problem. All new results are being published in journal articles. Author (TAB)

N70-15758*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
ACOUSTIC DUSTFEEDER
M. E. Morris 1969 17 p refs
(Contract NASA Order W-12853)
(NASA-CR-107694; PB-184308; SC-DC-69-1834) Avail: CFSTI CSCL 13G

In order to study the deposition of particles from an airstream a device was constructed to generate a continuous aerosol from a particle bed. The device generates an aerosol by passing a stream of clean air through a bed of particles that are fluidized by audio frequency oscillations of a membrane below the particles. The technique discussed appears to be a satisfactory method for generating a constant and continuous supply of an aerosol composed of particles in the 5–25 micron particle diameter range. Author (USGRDR)

N70-15775# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
THE RADIATION CHEMISTRY OF HIGH POLYMERS Final Report
Dole Malcolm Sep. 1969 17 p refs
(Contract AT(11-1)-1088)
(COO-1088-37) Avail: CFSTI

The fate of alkyl free radicals that survive in polyethylene on heating to room temperature after irradiation at 77 K is discussed. Evidence indicates that these surviving radicals convert to allyl free radicals at room temperature and to nothing else. The radiation chemistry of polypropylene and polypropylene oxide was also studied. NSA

N70-15778# Aerospace Corp. El Segundo, Calif.
THE CHEMICAL KINETICS OF PHOTOCHEMICAL SMOG AS ANALYZED BY COMPUTER

Karl Westberg and Norman Cohen 30 Dec. 1969 29 p refs
(ATR-70(8107)-1) Avail: CFSTI

A mechanism is proposed for the formation of photochemical smog produced by the atmospheric photooxidation of trace amounts of isobutene in the presence of equally small amounts of nitrogen dioxide. Computer calculations show that this mechanism reproduces the smog chamber measurements of Schuck and Doyle. This mechanism predicts that, contrary to current beliefs, carbon monoxide may play a role in the production of ozone in polluted atmospheres. Author

N70-15800# Louvain Univ. (Belgium). Lab. for Inorganic Chemistry.
IONS PRODUCED BY CHEMICALLY REACTING SYSTEMS Final Scientific Report, 1 May 1967 – 30 Apr. 1969
A. Van Tiggelen and S. De Jaegere 30 May 1969 14 p refs
(Grant AF-EOAR-67-53)
(AD-695498; ARL-69-0143) Avail: CFSTI CSCL 21/2

An investigation was made on the processes of chemi-ionization, on the formation of secondary ions by charge transfer, on ion-molecule reactions, and on the rate of ion recombination in methane-oxygen flammable mixtures. This study was extended to flammable mixtures of carbon monoxide or hydrogen with oxygen with small amounts of methane. A kinetical interpretation of the data is discussed. The possibility of applying a method of flashphotolysis and kinetic conductimetry to the study of chemi-ionization was examined. The influence of the partial pressure of oxygen atoms and fuel molecules on chemi-ionization rates was established in explosions of hydrogen-oxygen mixtures doped with hydrocarbons or ammonia. Ion-electron recombination coefficients were measured for the same explosions. Author (TAB)

N70-15825# Cornell Univ., New York. Materials Science Center.
X-RAY STUDY OF THE PRECIPITATION OF HYDROGEN IN VANADIUM
A. Bonfiglioli and B. W. Batterman 20 Aug. 1969 14 p refs Supported by AEC
(NYO-3789-8; Rept-1217) Avail: CFSTI

An investigation of impurity hydrogen effects on vanadium single crystals is reported. Results indicate that the precipitation is the final stage of a nucleation and growth process. NSA

N70-15828# Army Coating and Chemical Lab. Aberdeen Proving Ground, Md.
SYNTHESIS AND STUDY OF LACTATES AS LOW-HYGROSCOPIC BRAKE FLUID COMPONENTS Interim Report
Allan R. Brause and David W. Lipp Sep. 1969 14 p refs
(AD-694361; CCL-271; IR-2) Avail: CFSTI CSCL 11/8

The object of the work was to synthesize and study a series of esters of lactic acid as potential components of low hygroscopic brake fluids. Six diesters and nine monoesters were prepared via modified Fischer esterification. They were subjected to screening tests reported herein. None proved entirely satisfactory, although some of the lactates exhibited properties which may be desirable in blending. Author (TAB)

N70-15838# California Inst. of Tech., Pasadena.
STUDIES IN CHEMICAL DYNAMICS AND RADIATION CHEMISTRY Technical Progress Report, 1 Jul. 1968 – 30 Jun. 1969
Aron Kuppermann 1 Jul. 1969 35 p refs
(Contract AT-(04-3)-767)
(CALT-767-P-4-54) Avail: CFSTI

Research progress is reported on: low energy electron scattering, photoelectron spectrometry, elementary reactions by photolysis at various wavelengths, collisions in crossed molecular beams, and theory of chemical reactions. NSA

N70-15844# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
IODINE AND NOBLE GAS RETENTION STUDIES Progress Report, Oct. – Dec. 1968
Robert C. Milham and Larry R. Jones Aug. 1969 22 p refs
(Contract AT-(07-2)-1)
(DP-1209) Avail: CFSTI

The removal of iodine from activated carbon by flowing air was measured to evaluate various carbons and to evaluate the effects of variables, such as service, temperature, partial regeneration, iodine loading, and face velocity on iodine desorption. The effect of gamma radiation on the adsorption of iodine and methyl iodide on activated carbon exposed to flowing mixtures of steam and air was measured. Test conditions simulated a postulated loss-of-coolant accident where adsorption of radioiodine on carbon beds in the confinement system would produce an intense gamma field. Author (NSA)

N70-15845# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
MASS SPECTROMETRIC-THERMOGRAVIMETRIC TECHNIQUE FOR EVALUATING THE GAS RELEASE POTENTIAL OF SINTERED THORIA
Philippe Chastagner Sep. 1969 9 p refs
(Contract AT(07-2)-1)
(DP-1201) Avail: CFSTI

A mass spectrometric – thermogravimetric technique coupled with electrochemical moisture determinations is described for the characterization of sintered thoria. The data obtained can be used to evaluate the gas release potential of thoria during reactor irradiation to produce U-233. Author (NSA)

N70-15857# Mellon Inst., Pittsburgh, Pa.
EXPLORATORY DEVELOPMENT AND ANALYTICAL SUPPORT OF EXPERIMENTAL MATERIALS Final Report, 1 May 1968 – 1 Feb. 1969
William G. Fateley and John J. Mc Govern Jul. 1969 195 p refs
(Contract F33615-68-C-1369)
(AD-694525; AFML-TR-69-133) Avail: CFSTI CSCL 7/4

Contents: Molecular spectroscopy; Barriers to internal rotation(torsions); Far infrared studies of the hydrogen bond; Metal-organic and organic compounds; Inorganic compounds; Internal reflection spectroscopy in the far infrared region; Determination of unique molecular formulae from mass spectral data; Computer processing of high resolution mass spectra data; Purification of 1,1-diiodoferrocene; Gas chromatography. Author (TAB)

N70-15900# Argonne National Lab., Ill.
STUDY OF TRANSIENT HEAT TRANSFER FROM A WATER-IMMERSED ALUMINUM FUEL-PLATE SAMPLE IN TREAT
Lawrence J. Harrison Apr. 1969 41 p refs
(Contract W-31-109-eng-38)
(ANL-7563) Avail: CFSTI

During a photographic study of the chemical reactions between water and aluminum alloy plate type fuel samples subjected to nuclear transients, time – elapse and energy – input data were obtained for incipient nucleate boiling, stable film boiling, and high temperature physical and chemical responses of the sample. These data were used to calculate the transient temperatures, heat fluxes, and heat losses from the samples. The modes of transient heat transfer considered were conduction, nucleate boiling, film boiling, and radiation, all under highly subcooled pool conditions. Calculations were begun at ambient temperature and are taken on past sample melting to high temperatures at which the chemical reaction occurs at a significant rate; one typical experiment had a calculated peak sample temperature of 1590 C. The transient energy release rates were in the range from 100 to 200 msec, and all the experiments

were conducted at 12.3 psia. The temperature range considered in this study far exceeded the ranges previously reported, and this is the only study which used reactor fuel as the heat source.
Author (NSA)

N70-15903# Aerospace Corp., El Segundo, Calif. Lab. Operations.
CHARGE TRANSFER SPECTRA OF TRANSITION METAL IONS IN CORUNDUM Technical Report, Oct. 1966–Jan. 1969
Harry H. Tippins 29 Aug. 1969 50 p refs
(Contract F04701-69-C-0066)
(AD-694512; TR-0066(5250-20)-1; SAMSO-TR-69-284) Avail: CFSTI CSCL 20/12

The ultraviolet absorption spectrum of corundum (Al2O3) containing dilute concentrations of the 3d series transition metal ions Ti(3+), V(3+), Cr(3+), Mn(4+), Fe(3+), and Ni(3+) was measured at room temperature and at liquid nitrogen temperature for photon energies in the range 3 to 9 eV. The most important features of the observed spectra are: (1) the peak positions are characteristic of the particular impurity ion; (2) the peak positions and widths (0.7 eV) are independent of temperature over the range studied; and (3) the integrated intensities are strong. The spectra are identified with the allowed transition whereby an electron is transferred from a nonbonding orbital, localized predominantly on the O(-2) ligands, to either the t2g(pi*) or eg(sigma*) antibonding orbital, localized predominantly on the metal ion. The position in energy of the first absorption peak for the various ions of the series relative to one another and to the position of the intrinsic absorption edge of Al2O3 is in good agreement with the charge transfer model.
Author (TAB)

N70-15909# California Univ., Livermore. Lawrence Radiation Lab.
THE VAPOR PRESSURE OF PENTAERYTHRITOLTETRANITRATE (PETN) IN THE TEMPERATURE RANGE OF 50 TO 98 DEGREES CENTIGRADE
Francis T. Crimmins 11 Jul. 1969 11 p refs
(UCRL-50704) Avail: CFSTI

The vapor pressure of pentaerythritoltetranitrate (PETN) was determined in the temperature range from 50 to 98 C using the effusion technique developed by Knudsen. A least squares reduction of the experimental data gave the following equation: log P sub mm = 14.44 – 6352/T. The enthalpy or latent heat of sublimation calculated from this equation is 29.0 kcal/mole.
Author (NSA)

N70-15910# Colorado Univ., Boulder.
SPECIFIC ATTRACTIONS IN ION EXCHANGE Final Report
Harold F. Walton 24 Sep. 1969 5 p
(Contract AT(11-1)-499)
(COO-499-21) Avail: CFSTI

Attempts are being made to develop better methods of automatic column monitoring in liquid chromatography. Methods were developed for cation–exchange separation of silver from lead. Ligand-exchange chromatographic techniques were developed for drugs derived from phenethylamine.
NSA

N70-15913# Louisiana State Univ., Baton Rouge.
A PHYSICO-CHEMICAL STUDY OF SOME AREAS OF FUNDAMENTAL SIGNIFICANCE TO BIOPHYSICS Annual Report, 1968–1969
S. P. McGlynn 15 May 1969 24 p refs
(Contract AT(40-1)-3018)
(ORO-3018-53) Avail: CFSTI

A bibliography of twenty-five papers in which research is reported is included. Studies on the luminescence of the hydroxyl radical in various systems and the luminescence of simple nonaromatic carboxylic acids are reported. Studies on electronic states of inorganic oxyanions were initiated. Phosphorescence emission of ten nitrate salts in various media were observed. Phosphorescence spectra, excitation spectra, absorption spectra, and phosphorescence decay times were recored for NaOCN, DOCN, Cd(OCN), Pb(OCN)2, Hg(OCN)2, Ag(OCN), CH3NCO, CH3CH2NCO, and C6H5NCO. A discrepancy was noted between experimentally observed and calcuated f-values in an effort to assign electronic transitions to molecules of ethylene and its alkyl substituted derivatives. Phosphorescence lifetimes of methylnaphthalene derivatives at 77 and 4.2 K are tabulated. A method was developed for the preparation of poly(methylmethacrylate). Luminescence emissions were observed for solid K3CuCN4 and BaPt(CN4)4 . 4H2O.
NSA

N70-15914# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
RADIATION CHEMISTRY OF MATERIALS USED IN PLUTONIUM PROCESSING
Armen R. Kazanjian and Alan K. Brown 4 Sep. 1969 16 p refs
(Contract AT(29-1)-1106)
(RFP-1376) Avail: CFSTI

There are many materials used in plutonium fabrication that are highly susceptible to radiolytic decomposition. The radiation chemistry of those materials used at Rocky Flats is summarized. The radiolysis products are, in general, reactive toward plutonium and could lead to corrosion. However, the extent of radiation damage depends on the exposure conditions.
Author (NSA)

N70-15915# Brown Univ., Providence, R.I.
ELECTROLYTE GROWTH AND PROPERTIES OF TRANSITION METAL COMPOUND SINGLE CRYSTALS Summary Technical Report, 1 May 1967–30 Apr. 1969
Aaron Wold Jul. 1969 43 p refs
(Contract AF 33(615)-3844)
(AD-694526; AFML-TR-69-191) Avail: CFSTI CSCL 11/2

Single crystals of Fe P, Fe2 P, Co As2 and Fe As2 were grown by either electrolysis of fused salts or chemical transport. Of these four compounds prepared to date, extensive studies have been carried out on well-characterized crystals of Fe P. This compound exhibits metallic behavior throughout the temperature range of 4.2 K to 298 K. Anomalies in the magnetic susceptibility and resistivity curves at about 120 K have been correlated with an ordered antiferromagnetic spiral. The other compounds have been chemically analyzed and their electrical and magnetic properties are being characterized. In addition, crystals of cadmium sulfide have been grown from the vapor phase with dimensions 12 mm long × 9 mm wide × 0.2 mm thick. The resistivity of these crystals was found to be 2,000,000 ohm-cm at room temperature. On heating these crystals to 800 C for 4 hours and quenching to room temperature, the resistivity was found to be 219.3 ohm-cm.
Author (TAB)

N70-15991 National Lending Library for Science and Technology, Boston Spa (England).
MOLECULAR WEIGHT DISTRIBUTION AND SOLUTION PROPERTIES. EFFECT OF MOLECULAR WEIGHT DISTRIBUTION ON VISCOSITY RELATIONSHIPS
N. Yamada et al [1969] 11 p refs Transl. into ENGLISH from Kobunski Kagaku (Tokyo), v. 19, 1962 p 307–312
(NLL-M-7760-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The constants found experimentally for the intrinsic viscosity-molecular weight relationship (viscosity law) are known to change with the molecular weight distribution of the high molecular material used for the measurements. This change is basically due to the fact that the molecular weight found experimentally is not the viscosity average molecular weight required by theory, but the weight average molecular weight M sub w, or the number average molecular weight M sub n. The molecular weight distribution measured by the sedimentation method is used and the way in

which M sub w or M sub n and M sub v are correlated with the width of the molecular weight distribution is determined experimentally. The amount of fractionation of the material necessary to obtain accurate viscosity relationships is found. The best measure of molecular weight distribution width to use for reasonable results is discussed and M sub w/M sub n is found to be the best. The dependence of the sedimentation and diffusion constants on molecular weight is also discussed. Author

N70-16014# Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF MICROIMPURITIES EXHALED BY MAN

Yu. G. Nefedov et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 102–110 refs (See N70-16001 05-04)
Avail: CFSTI

Air exhaled by healthy individuals ages 25 to 35 was analyzed for microimpurities. The analysis was made using gas liquid chromatography, paper chromatography, colorimetry, and nephelometry. The following compounds were found: ammonia, aldehydes (formaldehyde and acetaldehyde), ketones (acetone and methylethyl ketone), ethane, propane, pentane and hexane. Most of the detected compounds were quantitatively measured. Analysis of the air exhaled by man may be of significance in the diagnosis of various diseases and study of metabolic processes, as well as for investigation of atmospheric changes in space cabins during long term manned flights. Author

N70-16015# Joint Publications Research Service, Washington, D.C.

METHOD FOR EVACUATING A GAS-AIR MIXTURE FROM SEALED CONTAINERS WHEN CONDUCTING SANITARY-CHEMICAL INVESTIGATIONS OF SYNTHETIC MATERIALS

V. D. Bartenev et al *In its* Space Biol. and Med., Vol. 3, No. 5 31 Dec. 1969 p 118–123 refs (See N70-16001 05-04)
Avail: CFSTI

A method is described for sampling air from sealed containers during investigations of gas discharges from polymers. Air is evacuated from the container by displacement using an elastic piston. The elastic piston was fabricated from the fluoroplastic film F-26. This film has a negligible vapor permeability and is applicable for sampling most synthetic materials, with the exception of ketones and acetates. E.C.

N70-16018# Atomic Energy of Canada, Ltd., Ottawa (Ontario). Commercial Products Div.

INTRODUCTION OF THERMAL STABILITY AND OTHER CHARACTERISTICS TO NYLON MOULDING POWDER BY RADIATION INDUCED REACTIONS

Sharda Dasgupta Nov. 1969 29 p refs Presented at the 27th Ann. Tech. Conf., Soc. of Plastics Engr. Inc., Chicago, 5–9 May 1969
(AECL-3511) Avail: CFSTI: Atomic Energy of Can., Ltd., Chalk River: $1.00

Radiation induced reactions were used to graft styrene and acrylonitrile monomers onto nylon moulding powders to yield products superior to the starting material in many respects. Characteristics desired can be imparted by proper choice of monomer and extent of grafting. The more important properties achieved are stability to heat, resistance to chemicals, moisture and radiation and improved mouldability. The procedures for carrying out the reactions and the results of physical and chemical tests on the products are described. Author

N70-16030 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.

METHODS OF PREPARATION OF ELECTRODES FOR ELECTROCHEMICAL MEASUREMENTS

V. G. Bunzhe Feb. 1969 7 p refs Transl. into ENGLISH from Tr. Inst. Khim. Nauk. Akad. Nauk Kaz. SSR (USSR), v. 12, 1964 p 157–159 In RUSSIAN and ENGLISH
(NLL-LTI-746-107-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

A method is described for preparing metal cathodes and current leads which prevents organic contaminants from affecting the cathodic processes. A vessel of 100 to 200 ml capacity with an external N10 ground joint at the end is inserted into an electrode holder, which also has an internal ground joint of the same size and a ground bottom face. A carefully polished aluminum plate, which is connected to the negative pole of a current source, is placed under the bottom face. An anode in the form of a platinum wire is mounted in the top part of the vessel. After assembly of the apparatus, an electrolyte solution is poured into the vessel and electrolysis is performed at a current density of 600 A/sq m for 15 to 25 hours. The zinc from the electrolyte solution is deposited on the aluminum, gradually filling the lower part of the holder and firmly adhering to the walls. The resulting deposit is completely impermeable to the solution and has a flat surface which can be utilized for direct measurements after light polishing. The surface can also be employed as a substrate for the external deposition of zinc or any other metal. R.B.

N70-16031# Bureau of Mines, Washington, D.C.

FACTORS AFFECTING THE PRODUCTION OF PHOSGENE USING GAMMA RADIATION

Arne Landsberg and F. E. Block Jan. 1970 19 p refs
(BM-RI-7338) Avail: CFSTI

Experiments were made with a batch reactor to determine the effect of gas pressures, temperature, and gamma radiation intensity on the reaction CO + Cl2 yields COCl2. An equation is given which bests fits the data. Oxygen and a large ratio of reactor surface to volume retarded the reaction, but inert gases had no effect. A low-temperature reactor system is proposed to take advantage of the conditions which give a high reaction rate with gamma radiation and a simple scheme of product purification. Author

N70-16033# Pennsylvania State Univ., University Park. Dept. of Materials Science.

PARTIAL PHASE DIAGRAM FOR THE YCd SUB 3 Zn PSEUDO-BINARY SECTION OF THE YTTRIUM-CADMIUM-ZINC SYSTEM

B. H. Hahn and E. Ryba 18 Mar. 1969 9 p refs
(Contract DA-31-124-ARO(D)-129)
(AD-695294; AROD-4345-4-MC) Avail: CFSTI CSCL 11/6

The phase boundaries in the composition range o-20 wt.% zinc for the YCd3-Zn pseudo-binary section of the yttrium-cadmium-zinc ternary system are presented. The boundaries were determined through differential thermal analysis, metallographic, and X-ray diffraction studies. A ternary compound which decomposes peritectically at 757C was found in this composition range. This compound, whose composition was established to be (YCd3)3Zn2 from neutron activation analyses and density measurements, is hexagonal with a=15.103, c=14.985A. Author (TAB)

N70-16038# Notre Dame Univ., Ind. Radiation Lab.

BIBLIOGRAPHY ON THE RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS. 1. AMINO ACIDS

Aug. 1969 18 p refs
(COO-38-641) Avail: CFSTI

One hundred and sixty-five references listed by year and alphabetically by first author within each year are given. NSA

N70-16042# Dow Chemical Co., Golden, Colo. Rocky Flats Div.

CHEMISTRY IN NONAQUEOUS SOLVENT SYSTEMS: A

TEN-YEAR ANNOTATED BIBLIOGRAPHY
William R. Strickland 18 Aug. 1969 17 p refs
(Contract AT(29-1)-1106)
(RFP-1339) Avail: CFSTI

The open literature for the past decade was surveyed for accounts of explorations in nonaqueous (organic) solvent systems. Those references pertinent to programs under consideration were tabulated and annotated. Subject and author indexes are included for the 138 references. Author (NSA)

N70-16048# Yale Univ., New Haven, Conn. Dept. of Physics.
A AND M PHYSICAL AND OPTICAL OBSERVATIONAL SPECTROSCOPY AND BREAKDOWN Final Technical Report
V. W. Hughes, W. E. Lamb, Jr., and G. J. Schulz 30 Jul. 1969 40 p
(Contract F44620-69-C-0018; ARPA Order 1011)
(AD-695831; AFOSR-69-2058TR) Avail: CFSTI CSCL 7/4

The goal of the research program is to study collisions of low-energy electrons with atoms and molecules, using time-of-flight techniques for achieving high energy resolution. During the contract period a versatile system was built which consists of an electron-optical bench in an environment suitable for experiments with low-energy electrons. A detailed description of this system is given. Various design studies for time-of-flight components were made. The results of those studies are outlined in the report. Experimental work on the dissociation of molecular hydrogen by electron impact, with the formation of metastable hydrogen atoms, is reported. Data acquisition using a computer and the design of new vacuum apparatus are described. A new tube is being constructed for the measurement of super-elastic collisions between electrons and molecules. TAB

N70-16050# Tennessee Univ., Knoxville. Dept. of Chemistry.
RESEARCH CONCERNING IONIC AND FREE RADICAL REACTIONS IN RADIATION CHEMISTRY Progress Report, 15 Sep. 1968 – 15 Sep. 1969
T. Ffrancon Williams Sep. 1969 11 p refs
(Contract AT(40-1)-2968)
(ORO-2968-49) Avail: CFSTI

Structural and chemical investigations are proceeding on dipole-trapped electrons in crystalline organic cyanides. Thermal decay rates of trapped electrons in 3-methylpentane glasses were studied. Intermediates in irradiated organic glasses and trapped electrons in polymers are discussed. Mechanisms of radioinduced polymerization are considered. The molecular weight distribution of polyisobutylene was determined as a function of irradiation temperature. ENDOR and ELDOR studies are being made of trapped electrons. NSA

N70-16051# Mound Lab., Miamisburg, Ohio.
CATION EXCHANGE METHOD FOR PREPARING PLUTONIUM DIOXIDE-238
G. L. Silver 15 Aug. 1969 29 p refs
(Contract AT-33-1-GEN-53)
(MLM-1569) Avail: CFSTI

A method was developed for preparing metal oxide microparticles in gram quantities by ignition of metal-loading resins. Satisfactory results were obtained only with cation exchange resins. The parameters for controlling the characteristics such as particle size, hardness, and density were determined. Plutonium dioxide microparticles prepared by the method described could serve as fuel materials in isotopic heat sources. Sintering of the loaded resins in the quartz apparatus used gave satisfactory particles that were often perfect microspheres. Metal oxide microparticles of several other elements, including thorium and zirconium, were also prepared by this process. Author (NSA)

N70-16058# Michigan Univ., Ann Arbor. Dept. of Chemistry.
THE DOUBLE OPTICAL RESONANCE SPECTRA OF ORGANIC AND INORGANIC MOLECULES Final Report
Thomas M. Dunn and Anthony H. Francis 4 Sep. 1969 33 p ref
(AF-AFOSR-865-67)
(AD-694084; AFOSR-69-2426TR) Avail: CFSTI CSCL 7/4

Double optical resonance spectra (DOR spectra) of the triplet state were obtained with great ease in the case of the aromatic hydrocarbons naphthalene and anthracene as well as from the halogenated derivatives alpha-chloro and alpha-bromonaphthalene. The lowest triplet state lifetime of these substances ranges from 2.6 seconds in the case of naphthalene to 18 milliseconds in the case of alpha-bromanaphthalene and no difficulty of any kind was experienced in obtaining good vibrational structure when these substances are dissolved in glassy solvents of the type of EPA. The inorganic ions of Cr(3+), Ni(2+), Tl(+) and Mn(2+) in a variety of physical conditions, i.e., both pure materials and as doped ions in host lattices, were also examined, but in no case was sharp vibrational structure, or even very well developed DOR spectra, observed. Results were limited to bleaching, which was observed in a number of these materials, and this has been previously reported, but the intensity of the bleaching and its rather diffuse form prompted a re-examination of the physical conditions being used in the experimental approach. Author (TAB)

N70-16063# Florida Univ., Gainesville. Dept. of Chemistry.
SYNTHESIS OF TRIPLE STRAND POLYMERS Final Report, 1 Jan. 1965 – 30 Jun. 1969
G. B. Butler and G. C. Corfield 30 Jun. 1969 49 p refs
(Grants AF-AFOSR-817-65; AF-AFOSR-817-67)
(AD-694123; AFOSR-69-2443TR) Avail: CFSTI CSCL 7/3

A wide variety of new and unusual compounds were synthesized and characterized. A significant contribution was made to the theory of decarboxylation of carboxylic acids in that the reaction is subject to steric control. Both cis- and trans-1,2,5-triisocyanatocyclohexane were synthesized; these compounds are functionally capable of cyclopolymerizing to linear polymers containing bicyclic and tricyclic units. Structural studies on the polymers obtained indicate that predominantly bicyclic structures were obtained. During the course of this work, a significant contribution was made to the theory of intramolecular cyclizations. A significant contribution was made to use of charge transfer complexes as intermediates in chemical reactions. Author (TAB)

N70-16067# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
PREPARATION OF HIGH-PURITY BORON NITRIDE POWDER
C. R. Schmitt and R. K. Edwards 6 Oct. 1969 56 p refs
(Contract W-7405-eng-26)
(Y-1688) Avail: CFSTI

Laboratory studies were made on the preparation of high-purity boron nitride powder by the reaction of a mixture of boric oxide and tricalcium orthophosphate with ammonia at 900 C. Many experimental parameters were studied, namely: reaction temperature, time at the reaction temperature, purity and dryness of gaseous ammonia, chemical removal of the calcium filler compound by dilute hydrochloric acid treatment, purification of boron nitride product by removal of unreacted boric oxide by alcohol extraction, low-temperature steam volatilization, and renitridation at 1400 C. Nitrogen analysis of laboratory-prepared boron nitride powder showed that 98.4% of the theoretical nitrogen content of boron nitride was obtained, and X-ray diffraction analysis identified hexagonal boron nitride as the major constituent with no other detectable intermediate or minor constituents. Various types of laboratory-prepared and commercial boron nitride powders were also characterized by electron photomicrographs. Author (NSA)

N70-16078 National Lending Library for Science and Technology, Boston Spa (England).
PHYSICAL PROPERTIES OF CARBONYL NICKEL POWDERS AND THEIR INFLUENCE ON TECHNOLOGICAL CHARACTERISTICS
A. M. Verblovskii et al 21 Jul. 1969 14 p refs Transl. into ENGLISH from Poroshkovaya Met. (Kiev), v. 9, no. 1, Jan. 1969 p 6–12 In ENGLISH and RUSSIAN
(NLL-LTI-746-134-(9022.401) Avail: Natl. Landing Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The main data are determined and systematized for the first time on the most important characteristics of carbonyl nickel powders, obtained in industry under various technological conditions. An effect is established of granulometric characteristics and specific surface of powders on their pressing and sintering ability. The possibility is shown and conditions in first approximation are found for obtaining the sintered parts of preset finite porosity of all kinds of carbonyl nickel powders, produced by the industry. Author

N70-16084# Iowa State Univ. of Science and Technology, Ames.
IONIC DOMAIN FOR YTTRIA DOPED THORIA AT LOW OXYGEN POTENTIALS
John Benjamin Hardaway, III Aug. 1969 41 p refs
(Contract W-7405-eng-82)
(IS-T-333) Avail: CFSTI

The emf method has been used to determine the low-oxygen potential limit for essentially pure anionic conduction in Th sub 0.85Y sub 0.150 sub 1.925. The temperature range covered in the investigation was from 775 to 1000 C. The results show that the oxygen transference number is greater than or equal to 0.99 under given conditions. Author (NSA)

N70-16089# Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Departamento de Quimica.
DETERMINING THE RATIO OF OXYGEN TO URANIUM IN URANIUM OXIDES OF HIGH PURITY. PART 1: APPLICATION TO POWDERED OXIDES [DETERMINACION DE LA RELACION OXIGENO/URANIO EN OXIDO URANOSO DE ALTA PUREZA. 1: APPLICACION A OXIDOS EN POLVO]
Jaime Casabe and Moises Botbol 1969 3 p refs In SPANISH; ENGLISH summary
(CNEA-244) Avail: CFSTI

A procedure for the determination of the ratio of oxygen to uranium in high purity uranous oxide has been developed. The method is based on the dissolution of the oxide in concentrated phosphoric acid and determination of the uranium (VI) present in the sample by a polarographic method. The dissolution of the sample is performed in inert atmosphere to avoid the effects of oxidation during this step. The relative standard deviation for oxides with O/U ratio near 2.1 is better than + or – 0.1%, and of the order of + or – 0.005% for the oxides with O/U ratio near 2.001. Author

N70-16090# Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Departamento de Quimica.
PREPARING THE SODIUM SALT OF THE FATTY BIS (NITROGEN 3 AMINO 2-4-6 BENZOIC TRI-IODIDE) IODINE 131 [PREPARACION DE LA SAL DE SODIO DEL ADIPOSIL BIS (N 3 AMINO 2, 4, 6 TRIIODO BENZOICO) I-131]
Stiliana Karaianev, Laura Quihillalt, and Aldo E. A. Mitta 1969 8 p refs In SPANISH; ENGLISH summary Presented at 1st Latin Am. Congr. of Clin. Biochem., Buenos Aires, Dec. 1968
(CNEA-245) Avail: CFSTI

A method for the labelling of iodopamide sodium salt by isotopic exchange between I-131 and inactive iodopamide sodium salt obtaining a radiochemical yield of 100% in only 15 minutes, is described. The effect of pH, temperature and molar relation between the reactants on the radiochemical yield is determined as well as the optimal storage conditions for the labelled molecules. Author

N70-16091# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
A HIGH-RESOLUTION LIQUID CHROMATOGRAPH
A. Verweij Aug. 1969 22 p refs
(Rept-1969-4) Avail: CFSTI

An apparatus for high resolution liquid chromatography is described. This technique is particularly used for the analysis of thermolabile, reactive or nonvolatile compounds which cannot be analyzed by gas chromatographic methods. After separation on the chromatographic column, the eluted compounds are detected by means of a differential refractometer. Some representative separations are described. Author

N70-16092# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
AEROSOL FILTRATION BY ELECTRIFIED FIBROUS FILTER MATS. 1 (A64/KL/022)
J. J. M. Thijssen Aug. 1969 28 p refs In DUTCH; ENGLISH summary
(Rept-1969-14) Avail: CFSTI

The potentials of aerosol filters composed of electrified synthetic fibers have been investigated. The results of a general investigation and some qualitative conclusions are given. It proved possible to obtain electrified synthetic fibers which, when formed into a fibrous filter mat, show increased efficiency as compared to nonelectrified fibers. The pressure drop across the filter is very low. Author

N70-16112# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TABLE OF SPECIFIC SPEEDS OF CHEMICAL REACTIONS USED IN AEROTHERMOCHEMISTRY [TABLEAU DES VITESSES SPECIFIQUES DE REACTIONS CHIMIQUES UTILISABLES EN AEROTHERMOCHIMIE]
Roger Prud'Homme and Claude Lequoy 1969 95 p refs In FRENCH; ENGLISH summary Sponsored in part by Direc. des Poudres
(ONERA-NT-147) Avail: CFSTI

This compilation lists the specific speeds of more than seven hundred elementary chemical reactions of the first, second, and third orders, used in aerothermochemistry. The formula used to express these specific speeds is written as a function of temperature only. All references are mentioned. The values for a particular reaction are chosen according to the chemical mixture under study and the thermodynamic conditions considered. Author (ESRO)

N70-16129*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
PROCESS OF PREPARING SHAPED SUBSTANCES IN POLYURETHANE AS WELL AS PRODUCTS ANALOGOUS TO THOSE OBTAINED BY THE PRESENT PROCESS OR A SIMILAR ONE [PROCEDE POUR LA FABRICATION DE CORPS DE FORME EN POLYURETHANES AINSI QUE LES PRODUITS CONFORMES A CEUX OBTENUS PAR LE PRESENT PROCEDE OU PROCEDE SIMILAIRE]
Washington NASA Jan. 1970 9 p Transl. into ENGLISH from French Patent no. FR1490316 (25 Aug. 1966) 4 p
(Contract NASw-1692)
(NASA-TT-F-12834) Avail: CFSTI CSCL 07C

Shaped nonflammable polyurethanes, optionally foamed, are prepared with the aid of organic halogen substances which are distributed uniformly in the mass, these substances being of the polyvinyl bromide type with given Br contents. The composition is then foamed and polymerized. Author

N70-16140# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
AEROSOLFILTRATION BY ELECTRIFIED FIBROUS FILTER MATS. 2 (A64KL/022)
J. J. M. Thijssen and P. Ziekman Aug. 1969 10 p refs In

DUTCH; ENGLISH summary
(Rept-1969-16) Avail: CFSTI

Filters of electrified polypropene or polyethyleneterephthalate can be used for the filtration of low concentrations of aerosols only, because of the adverse effect of loading with liquid aerosol on the filtration properties. By combining a good mechanical filter with an electrified filter the penetration may be lowered by a factor of 10 to 100 with negligible increase in resistance to air flow. This factor of 100 probably can still be increased by a suitable choice of materials and the conditions of formation of the electrified fibrous filter mat. Author

N70-16141# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
A LITERATURE STUDY ABOUT THE POSSIBLE USE OF A LASER AS A LIGHT SOURCE IN A PARTICLE COUNTER
F. Oesburg 1969 8 p refs
(Rept-1969-9) Avail: CFSTI

Since the aerosol penetration through a glass fiber filter depends strongly on the particle size, determination of the particle size distribution is very important. Not only in filtration studies but also in other aerosol fields, determination of the particle size distribution is necessary. Light scattering can be applied with success, since there is a correlation between the amount of light scattered by a particle and the particle size. The smallest particles that can be detected by this technique are about 0.3 microns in diameter. Factors determining the quality of the particle counter are sensitivity, resolving power and concentration. It was concluded that the laser was more suitable than the particle counter for filtration purposes. Author

N70-16142# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
PREPARATION OF 3,5 DIACETYLAMINO 2,4,6 TRIIODO BENZOIC ACID IODINE-131 [PREPARACION DEL ACIDO 3,5 DIACETILAMINO 2,4,6 TRIYODOBENZOICO I-131]
Stiliana Karsianev, Alberto Cella, and Aldo E. A. Mitta 1969 6 p refs In SPANISH
(CNEA-248) Avail: CFSTI

A method for the labelling of 3,5 diacetylamino 2,4,6 triiodo-benzoic acid (Hypaque) by isotopic exchange between I-131 and inactive hypaque obtaining a radiochemical yield of 100% in only ten minutes, is described. The effects of pH, temperature and molar relation between the reactants on the radiochemical yield as well as the optimal storage conditions for the labelled molecule, are evaluated. Author

N70-16148# California Univ., Berkeley. Lawrence Radiation Lab.
COMPUTER PROGRAMS FOR AN IMPROVED EQUATION OF STATE (ES68Z AND ES68M)
Otto Redlich and Victoria B. T. Ngo May 1969 69 p refs
(Contract W-7405-eng-48)
(UCRL-19011) Avail: CFSTI

Two FORTRAN programs for the use of the new modification of the equation of state of Redlich and Kwong are presented and their application is described in detail. Program ES68Z computes the compressibility factor for a flexible temperature – pressure schedule. Program ES68M leads, in addition, to fugacity coefficients, enthalpies, and entropies. It can be used for mixtures and furnishes individual fugacity coefficients. Author (NSA)

N70-16150# Oak Ridge National Lab., Tenn.
RADIATION-INDUCED REACTIONS OF SOME FURAN CHEMICALS
J. J. J. Myron and W. W. Parkinson Aug 1969 25 p refs
(Contract W-7405-eng-26)
(ORNL-4373) Avail: CFSTI

The products of irradiating tetrahydrofuran, furfural, tetrahydrofurfuryl alcohol, and dimethyl sulfoxide, individually and in mixtures, have been investigated for commercial potential. Solutions of pentadiene in furfuryl alcohol, in tetrahydrofurfuryl alcohol, and in furfural have been irradiated and examined more briefly. In tetrahydrofuran and dimethyl sulfoxide only products observed in the desirable molecular weight range of dimers and trimers were observed. In these cases the yields were not over 5 molecules per 100 eV, inadequate for commercial exploitation. The major radiation product from furfural was a complex polymer at the rate of 4 molecules of furfural incorporated per 100 eV. A considerably higher polymer yield, probably about 13 molecules incorporated per 100 eV was observed in solutions of pentadiene in furfuryl alcohol. Author (NSA)

N70-16161# Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.
THE STRUCTURE OF BORAZINE
W. Harshbarger, G. Lee, R. F. Porter, and S. H. Bauer 1969 10 p refs Sponsored by NSF and AROD
(Contract DA-31-124-ARO-D-320)
(AD-695280; Rept-4890-19-C) Avail: CFSTI CSCL 7/2

The molecular structure of borazine ($B_3N_3H_6$) was reinvestigated by electron diffraction. A planar D(3h) model and two nonplanar (C(3v) and C(2)) models were fitted to the diffraction data. For two sets of data the nonplanar models statistically fit the observed diffraction data better than did the planar model. Owing to the absence of a permanent dipole moment for borazine, the C(2) model or a D(3h) model with very large vibrational motion is preferred; the choice between these is not unambiguous. Author (TAB)

N70-16174# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
DETERMINATION OF THE RATIO OF OXYGEN TO URANIUM ON HIGH PURITY URANOUS OXIDE APPLIED TO SINTERED OXIDE PELLETS [DETERMINACION DE LA RELACION OXIGENO/URANIO EN OXIDO URANOSO DE ALTA PUREZA. APLICACION A PASTILLAS DE OXIDO SINTERIZADO]
Jaime Casabe, Enrique E. Garcia, and Moises Botbol 1969 8 p ref In SPANISH; ENGLISH summary
(CNEA-250) Avail: CFSTI

A procedure for the determination of the ratio oxygen/uranium on sintered pellets of high pruity uranous oxide has been developed. The method is based on the partial dissolution of the pellet in concentrated phosphoric acid using a specially designed apparatus which permits processing under inert atmosphere. The uranium (VI) present in the sample is determined by a polarographic procedure, and the uranium (IV) by a potentiometric titration. The procedure described allows successive determinations of the oxygen/uranium ratio on the same pellet, and may be applied to the determination of oxygen/uranium ratios within the range 2.1 to 2.001. Author

N70-16175# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
PREPARATION OF IODOFORM I-131 [PREPARACION DE IODOFORMO I-131]
Ricardo J. Correia and Aldo E. A. Mitta 1969 8 p refs In SPANISH; ENGLISH summary Presented at 2d Latin Am. Congr. on Nucl. Biol. and Med., Buenos Aires, 1968
(CNEA-254) Avail: CFSTI

A method to prepare iodoform I-131 with a 70% radiochemical yield is described. The effect of pH, temperature, light and solvents on the radiochemical yield is determined as well as the optimal storage conditions for the labelled molecule. Author

N70-16176# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
PREPARATION OF BROMOSULPHALEIN IODINE 131 [PREPARACION DE BROMOSULFTALEINA I-131]
Amanda F. de Suarez, Silvia Gomez, and Aldo E. A. Mitta 1969

8 p refs In SPANISH; ENGLISH summary Presented at 2d Latin Am. Congr. on Nucl. Biol. and Med., Buenos Aires, 1968
(CNEA-253) Avail: CFSTI

A method to prepare bromosulphalein I-131 with a radiochemical yield of 100% in a few minutes is described.
Author

N70-16179# Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Departamento de Quimica.
SYNTHESIS OF THE METHYE ESTER OF EICOSA-11, 14-DIENOIC-1-CARBON-14 [SINTESIS DEL METIL ESTER DEL ACIDO EICOSA-11.14-DIENOICO-1-C-14]
A. Catala (La Plata Univ.), R.R.Brenner (La Plata Univ.), C. A. Arciprete, and A. E. A. Mitta 1969 10 p refs In SPANISH; ENGLISH summary
(CNEA-252) Avail: CFSTI

The syntheses of unlabelled and 14C-labelled eicosa-11,14-dienoic acid were carried out as follows: monoine propargyl bromide was condensed with omega-alkyne-1-chloride; the polyine chloride was partially hydrogenated over Lindlar catalyst and the resulting polyene chloride treated with K14CN in dimethylsulfoxide. The nitrile obtained was hydrolized and converted into the methyl ester with methanol-HCl and the free acid was then liberated by mild alkaline hydrolysis. This method is suitable for the synthesis of all cis fatty acids.
Author

N70-16180# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
DIVISION MOLECULAS MARCADAS. PREPARATION OF IODINE-131 LIPIDS [PREPARACION DE LIPIDOS I-131]
Hugo Albani and Aldo E. A. Mitta 1969 5 p refs In SPANISH; ENGLISH summary
(CNEA-247) Avail: CFSTI

Increasing the rate of lipids to radioactive Cl I an instant reaction upon the lipids with 100% radiochemical yield is achieved.
Author

N70-16192 National Lending Library for Science and Technology, Boston Spa (England).
RADIO GAS-CHROMATOGRAPHIC ANALYSIS OF FATTY ACID METHYL ESTERS AND STEROIDS
S. Kolb et al 18 Jul. 1969 19 p Transl. into ENGLISH from Z. Anal. Chem. (Berlin-Wilmersdorf (West)), v. 243, 20 Dec. 1968 p 129 - 142
(NLL-Trans-1152-(9022.9)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Comparative investigations made on radio gas chromatography with a flowthrough proportional counting tube, according to both the hydrogenative and oxidative degradation procedures, of gas-chromatographically separated C-14 and H-3 compounds are described. The determination of specific activities for C-14 labeled methyl esters of fatty acids gave a good agreement of the results for the hydrogenative and oxidative degradations. Examples for the analysis of H-3 labeled steroids according to the hydrogenative degradation and of C-14 labeled steroids according to the oxidative degradation are shown. Also, the possible application of thin layer capillaries in radio gas chromatography is discussed.
Author

N70-16196# Council for Scientific and Industrial Research, Pretoria (South Africa).
SORPTION OF PLATINUM AND PALLADIUM COMPLEX IONS ON AMPHOLYTES [SORBTSIIA KOMPLEKSNYKH IONOV PLATINY I PALLADIIA NA AMFOLITAKH]
A. N. Popov et al 1969 9 p Transl. into ENGLISH from Izv. Sibirsk. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk (Novosibirsk), v. 11, no. 3, 1968 p 80-3
Avail: CFSTI

Sorption and desorption of platinum and palladium by amphoteric ion exchangers were investigated. Tests were performed on samples of ampholyte and a weakly basic anion exchanger under static conditions in hydrochloric acid and sodium hydroxide solutions. Platinum and palladium were in the form of hydrochloride solutions. Distribution coefficients for the degree of sorption are given in tabular form. A method for separating platinum and palladium was developed by correlating the sorptive properties of amphoteric ion exchangers in acid and alkaline solutions.
J.M.C.

N70-16235# Boeing Scientific Research Labs., Seattle, Wash.
ON THE COLLECTION OF CHARGED PARTICLES FROM PHOTOIONIZATION
Richard I. Schoen Dec. 1968 12 p refs
(AD-694389; DI-82-07080) Avail: CFSTI CSCL 7/5

The case of photoionization in which charged particles are released with an angular distribution A + B(cos squared) is discussed with a view toward finding a method of measurement insensitive to the angular distribution. It is shown that measurements made at an angle of 54 degrees 44 minutes with respect to the direction of light propagation and with respect to the direction of the electric vector fulfill the requirement, and that the results do not depend on solid angle subtended by a circularly symmetric detector. Furthermore, a direction may be chosen which fulfills the requirement for light polarized in either of two perpendicular directions, light which is partially polarized symmetrically about certain axes, or unpolarized light.
Author (TAB)

N70-16248# Case Western Reserve Univ., Cleveland, Ohio. Electrochemistry Research Lab.
OXYGEN ELECTRODE KINETICS IN GOLD
Ronald W. Zurilla and Ernest Yeager 15 May 1969 231 p refs (Contract N00014-67-C-0389)
(AD-694951; TR-23) Avail: CFSTI CSCL 7/4

The research covered in the document was undertaken to achieve a better understanding of the oxygen reduction mechanism on gold by use of a rotating disk electrode with ring and to ascertain the role of hydrogen peroxide in the reaction path. Experiments were designed to control the amount of hydrogen peroxide in solution and to minimize the effect of impurities. Gold was chosen as an electrode material since surface oxide effects were expected to be minimal. The electrochemistry of O2 was studied on gold in 0.1 M NaOH and 0.1 M HClO4 with the rotating disk and ring-disk techniques. Care has been taken to prevent contamination of the solutions with impurities, particularly platinum. The result is that HO2(-) or H2O2 is formed during the reduction of O2 in alkaline and acid solutions and that most of the peroxide diffuses away from the electrode. The further reduction of HO2(-) in 0.1 M NaOH resulted in a significant contribution to the disk current in the potential range where O2 is reduced while the reduction of H2O2 in 0.1 M HClO4 contributed very little to the disk current. The ring-disk data in 0.1 M NaOH demonstrated that only a series reaction scheme (O2 yielding HO2(-) yielding OH(-) where HO2(-) is either the adsorbed or desorbed species) is operative.
Author (TAB)

N70-16254# Belgrade Univ. (Yugoslavia).
MATTER UNDER HIGH PRESSURES
P. Savic et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 25 - 31 refs (See N70-16251 05-13)
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Outlined are the principles of formation for systems consisting of atoms of chemical elements under elevated pressure. As the pressure increases, the electrons in the atomic clouds assume higher energetic levels and are finally ejected from the atom thus inducing a number of macroscopic effects. The change in density is jumpwise and results in ionization. Equations deduced from this assumption are used to calculate excitation and ionization potentials, various

elasticity parameters, and other physicochemical properties of material under high pressure. Since high pressures in celestial bodies are the result of both gravitational attraction and cooling, a real body at ambient temperature is compared with data calculated for the ideal case. It is found that: (1) if the mass is sufficiently large, spherical layers will be formed in the body even if its chemical composition remains constant with depth; (2) such a body, at absolute zero, cannot have a mass larger than the original mass; and (3) if the mass of the body increases, its radius first increases and then decreases. Application of this model shows how the earth became a layered body with a mass larger than that of a layered body of the same order and with the same composition at zero K during a period of cooling and undergoing contractions with internal layer formation. G.G.

N70-16255# Leningrad (A. A. Zhdanov) State Univ. (USSR).
STABILITIES OF COMPLEX MOLECULES AT HIGH TEMPERATURES AND THEIR POSSIBLE SIGNIFICANCE FOR GEOCHEMISTRY
S. A. Schukarev *In* Israel Program for Sci. Transl., Ltd. Probl. in Geochem. 1969 p 32–34 refs (See N70-16251 05-13)
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The dissolution effect of low-volatile oxides in water vapor above the critical point was evaluated from the point of view of thermodynamics and the nature of chemical bonds with emphasis on the geochemical significance of gaseous hydroxides readily converted by sublimation from the condensed state into vapor. Thermodynamic calculations showed that the volatilities of hydroxide under elevated water pressure around 1000 C demonstrated the relationship governing the distribution of elements in the layer's of the earth crust as well as in the formation of the earth's crust as a whole. G.G.

N70-16260# American Museum of Natural History, New York.
GEOCHEMICAL BEHAVIOR OF CERTAIN ELEMENTS IN METEORITES
B. Bason *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem, 1969 p 75–84 refs (See N70-16251 05-13)
Copyright, Avail: CFSTI

A survey on physicochemical behavior of elements in meteorites shows that distribution of a chemical element between different phases in a closed system is a function of its chemical affinity. In most chondrite meteorites iron is present as free metal, FeS, and ferromagnesian silicate. Only cobalt, nickel, and copper exist in the metallic state in common chondrites; iron lost its lithophile character and became siderophile and chalcophile in enstatic chondrites. Free energies of oxide formation indicate the sequence Cr, Mn, Si, Ti, Al, Mg, and Ca. G.G.

N70-16262# National Museum of Natural History, Paris (France). Mineralogical Lab.
METALLIC PHASE OF THE METEORITE FROM SAINT-SAUVEUR (HAUTE-GARRONE, FRANCE)
A. P. Sandres *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 96–111 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

The metallic phase in the meteorite was examined by reflected light microscopy and six minerals were identified, including oldhamite. It was found that about 45 percent of metallic phase volume consisted of nickel–iron concentrated in large monomineral particles within silicates. Nickel–iron was represented by kamacite containing 93 percent Fe and 6.65 percent Ni; its shape was regular, round, or elongated with serrated edges. It also contained troilite, inclusions of lustrous pentlandite, and nickel–iron phosphide with 5.5 percent nickel content. Crystals of pseudo-daubreelite structure contained titanium and a mineral bound to elements which cannot form oxides under redox conditions prevailing in enstatis. G.G.

N70-16263# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
SEPARATION OF ISOMORPHOUS ELEMENTS
V. V. Shcherbina *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 112–117 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

Discussed are the following crystallochemical and physicochemical factors in the separation of isomorphous elements: (1) major change in ionic size of one of the isomorphous elements caused by change in electric charge on the ion; (2) separation brought about by differing tendencies of the elements to form complexes; (3) separation of isomorphous elements by differing solubilities of their components in acid or alkaline media; (4) separation by distribution between anions of different acidities; (5) crystal lattice effects; (6) chemical compound formation with some given element by one of the isomorphous elements but not the other; (7) formation of different minerals belonging to the same structural group by isomorphous elements under different genetic conditions; (8) separation based on different sorption properties; and (9) biogeochemical separation based on specific interactions with biogenic matter. G.G.

N70-16264# Israel Program for Scientific Translations, Ltd., Jerusalem.
FACTORS INFLUENCING DISTRIBUTION COEFFICIENTS IN MINERAL FORMING PROCESSES
R. G. Burns et al *In its* Probl. of Geochem. 1969 p 118–127 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

Many of the discussions of element distribution and fraction during mineral forming processes are unsatisfactory because thermodynamic properties of only the solid phase containing the major or trace element are considered. Binding forces of relevant ions in the phase from which a mineral separates must also be taken into account. Results of absorption spectra measurements on silicate glasses of various compositions indicate that ions of the first transition-metal series are present in tetrahedral and octahedral sites in silicate melts (glasses). The fractionation patterns observed for transition-metal ions between magmas and silicate minerals are interpreted by Crystal Field Theory in terms of octahedral "site preference energies" of transition ions in crystal lattices. Author

N70-16266# Academy of Sciences (USSR), Moscow. Inst. of Geology of Ore Deposits, Petrography, Mineralogy, and Geochemistry.
DEDUCTION OF THERMODYNAMIC POTENTIALS OF OPEN SYSTEMS AT A GIVEN ACIDITY AND STATE OF OXIDATION
D. S. Korzhinskii *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 134–143 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

Extension of the fundamental method of thermodynamic potentials to acid base and redox systems is applied to geochemical solutions, anhydrous oxide melts, redox reactions, and systems with mobile positive hydrogen. When the number of particles of the inert component remains unchanged during decomposition or ionization the reaction equation, with allowance for the degree of decomposition or ionization, directly yields the coefficients required to find the derivative. The value of the derivative is equal to the coefficient preceeding the molecule of the acid or the hydrogen ion. If ionization of the inert component involves changes in the number of its particles, the dependance between the total activity coefficient and the acidity in acid-base reactions has to be established. G.G.

N70-16267# Cape Town Univ. (South Africa).
THE USE OF IONIZATION POTENTIALS IN GEOCHEMISTRY

L. H. Ahrens *In* Israel Program For Sci. Transl., Ltd. Probl. of Geochem. 1969 p 144–154 refs (See N70-16251 05-13)
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Magnitude and nature of atomic and ionic forces of atoms are expressed in the ionization potential which is used to classify several elements by their tendency to form ionic, covalent, or metallic bonds. Example studies presented on group I and group II elements consider their siderophile tendencies, cationic forces, chalcophile and lithopile tendencies, cationic radii, ionic structures, covalency and geochemical bonding, and organometal molecular bonding under geological conditions. G.G.

N70-16268# Stanford Univ., Calif.
RELATIVE VOLATILITIES OF FLUORIDES AND CHLORIDES OF ORE-FORMING METALS IN MAGMATIC GASES
K. B. Krauskopf *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 155–165 (See N70-16251 05-13) refs
Copyright. Avail: CFSTI

Fluoride and chloride volatility data are compared with volatilities estimated from boiling points of ore-forming metals in magmatic gases in order to obtain thermochemical data for quantitative evaluation. Comparative calculations on 19 metal halides confirm the use of the boiling point approximation index of vapor pressures. It is shown that:(1) metals with neither pronounced chloride nor fluoride volatilites below 80 degree C include Ca, Sr, Ba, and rare earth metals; (2) elements with chlorides but not fluorides markedly volatile below 800 degree C include Li, Na, Mg, Th, divalent Mn, trivalent Fe, Co, Ni, and Cd; (3) elements with more important chloride than fluoride effects in vapor transfer include Be, Al, Sc, U, Zn, Sn, Pb, and trivalent Ti, Cr, Mn, Fe; (4) silver fluoride is much more volatile than silver chloride under magmatic conditions; and (5) migration takes place as volatile chloride or fluoride above 400 degree C in all other elements investigated. G.G.

N70-16269# Academy of Sciences (USSR), Moscow. Dept. of Geochemistry and Analytical Chemistry.
MIGRATION OF URANIUM IN HYDROTHERMAL CARBONATE SOLUTIONS (ACCORDING TO PHYSIOCHEMICAL DATA)
G. B. Naumov et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 166–175 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

Uranium processes of migration and concentration in the earth crust were studied by evaluating redox reactions between uranium and a large number of metals, as well as by determinations of instability constants for complex uranyl-carbonate ions at elevated temperatures. Results emphasized the importance of complex uranyl-carbonate anions in the migration of uranium not only at temperatures prevailing on earth surface but also in phreatic zones of the earth's crust. Displacement of the redox equilibrium tetravalent U – U hexavalent in carbonate solutions explains the mechanism of hexavalent uranium motion in hydrothermal solutions together with ferrous iron, sulfide surfur, organic matter, and other reducing agents. Deposition of tetravalent uranium from solutions containing free Au, Ag, Bi, Cu, and Pb ions involves decomposition of complex anions at increased dioxide concentrations. It is concluded that changes in the concentration of carbon dioxide during degassing of ore-bearing solutions regulate the migration and accumulation of uranium ores. G.G.

N70-16271# National Museum of Natural History, Paris (France). Mineralogy Lab.
REACTIONS OF ALKALI FELSPARS WITH CALCIUM-BEARING HYDROTHERMAL SOLUTIONS BETWEEN 300 AND 600 DEG C
J. Wyart et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 190–204 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

When albite and adularia are brought into contact with hydrothermal solutions of calcium chloride, about one-third of the alkali-metal atoms can be substituted by calcium without major changes in the optical and crystallographic properties. A complete substitution of alkali metal by calcium results in the formation of anorthrite and separation of excess silica as small beads of cristobalite, which is ultimately transformed into quartz. These minerals, when brought into contact with solutions of calcium chloride saturated with calcite at 400 C, produce a mixture of wollastonite and anorthite and at more elevated temperatures a mixture of wollastonite and groesularite. These results are related to the formation of myrmekites, contact metamorphism of limestone and to the problem of plagioclases with excess silica. Author

N70-16279# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
EXPERIMENTAL STUDY OF THE BEHAVIOR OF RARE-EARTH ELEMENTS AND YTTRIUM AS APPLIED TO THE HYDROTHERMAL PROCESS
I. V. Aleksandrov et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 285–294 refs (See 70-16251 05-13)
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The behavior of rare earth elements in solutions related to the formation of their carbonates was studied because rare earth element carbonate deposits are one of the main raw material sources for rare earth extractions. Rare earth element carbonates were precipitated from acid solutions as simple salts by carbonate and bicarbonate ions and by acidification of alkali-metal carbonate solutions as complex compounds. In both cases cerium earths precipitated out first and yttrium earths last. The differing migration capacity of cerium and yttrium elements in alkali-metal carbonate solutions was effected by temperature; at temperatures of 250 to 300 degrees yttrium concentrations were much higher than that of cerium earths. This difference became smaller at even higher temperatures. Migration of yttrium earths and their separation from cerium earths can be produced in alkaline solutions. G.G.

N70-16301# Leningrad (G. V. Plekhanov) Mining Inst. (USSR). Dept. of Mineralogy.
PROPORTIONS OF IONIC AND COVALENT ARSENIC BONDS IN VARIOUS MINERALS AND THE CHANGES IN THE NATURE OF THE BONDS DURING MINERAL FORMATION
D. P. Grigorev *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 484–492 refs (See N70-16251 05-13)
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Electron structure of arsenic atoms, crystallochemistry of arsenic compounds, and data reported for arsenic bonds in minerals are evaluated for changes during mineral formation. Analysis of ionic and covalent arsenic bond distribution established that the series of valency states of arsenic begins with negative ionic bounding that is gradually replaced by atoms with gradually increased proportions of covalent bonds up to a fully covalent state; the positive character of the still covalent element then gradually increases until a state of positive valency is reached. Covalency is evident from the orientation of bonds in minerals which correspond to the configuration and distribution of electron orbits in arsenic atoms. Mutual proportions of ionic and covalent bonds of arsenic correspond to the crystallization sequence of arsenic-containing minerals; variations in ionic and covalent bond proportions during mineral formations are effected by the redox potential as it becomes more oxidative. G.G.

N70-16308# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
FORMS OF HYDROGEN OXYGEN BONDING IN GLAUCONITE AS RELATED TO THE LIBERATION OF ARGON FROM THE CRYSTAL LATTICE ON HEATING
G. V. Yukhnevich et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 535–545 refs (See N70-16251 05-13)
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Hydroxonium groups were not detected in the crystal structure of the glauconite group. The first plateau on the glauconite dehydration curve is produced by expulsion of water molecules present in the structure. The second plateau on the dehydration curve is produced by elimination from the glauconite structure of water molecules formed from hydroxyl groups which are present in widely differing contents in different samples. A new method is proposed for calculation of crystallochemical formulas of glauconite, based on a quantitative determination of hydroxyl groups. Evolution of argon from glauconites takes place simultaneously with decomposition of hydroxyl groups in the structure of the mineral. Author

N70-16315# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
PHOTOSYNTHETIC FORMATION OF ORGANIC COMPOUNDS IN THE BIOSPHERE
E. A. Boichenko et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 640-647 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

The problem of reduction of carbon dioxide has a major geochemical importance in view of the potential utilization of the enormous quantities of carbon dioxide in carbonate rocks in the synthesis of organic compounds, primarily food. A study of the most promising method of this reduction, viz., photosynthesis in green plants, showed that phosphatides and their oxidation products, carbohydrates, can be obtained as products of enzymatic reactions. Such reactions must take place in the presence of the flavin enzyme CoA which contains iron and manganese in order to produce the redox system in which this synthesis can proceed. Author

N70-16317# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
THE ISOTOPIC COMPOSITION OF OXYGEN LIBERATED BY PLANTS
V. M. Kutyurin *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 661-667 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

The isotopic shift of oxygen-18 in the oxygen evolved by plants with relation to water was examined by determining effects of sodium azide and the nature of light on the absorption of oxygen by plants. It was shown that oxygen absorption by plants in blue light in the presence of sodium azide inhibits metal-containing enzymes and suppresses photosynthesis; the isotope fractionation coefficient does not decrease. Intensive illumination of algae and water plants reduced intensity of the subsequent dark respiration and isotope fractionation disappeared at 50,000 lux. At weak illuminations, isotopic composition of oxygen became heavier and the degree of fractionation increased with temperature. It was concluded that water was the only source of photosynthetic oxygen and that carbon dioxide was not involved in its formation. Isotopic composition of oxygen evolved by plants was a function of illumination intensity, temperature, condition of the plant, and plant species. G.G.

N70-16319# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
THE CONTENT OF LITHIUM IN PLANTS
T. F. Borovik-Romanova *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 675-682 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

The relative content of lithium in plants and in the soils in which they grow was studied on 138 specimens in order to evaluate the importance of lithium for agriculture. Results indicated that lithium content in plants varied between 0.15 and 3 times 0.0001 percent and in some cases attained 19 to 200 times 0.0001 percent. Lithium content in plants depended on its availability in the soils and on the plant species since all plants did not absorb lithium at the same extent. Lithium content was highest in samples with alkaloid elements. G.G.

N70-16340# Boeing Scientific Research Labs., Seattle, Wash. Polymer Sciences Lab.
THE 1, 2, 4-TRIAZOLES AND 1, 3, 4-OXADIAZOLES FROM N-ACYLHYDRAZIDINES
Paul M. Hergenrother and Thomas J. Pratt Aug. 1969 21 p refs
(AD-694307; DI-82-0892) Avail: CFSTI CSCL 7/3

N-Acylhydrazidines were prepared from low temperature solution or interfacial condensation of hydrazidines (amidrazones) with carboxylic acid chlorides. The N-acylhydrazidines were quantitatively converted to the corresponding 1,3,4-oxadiazoles by heating in strong acids such as trifluoroacetic acid. Whereas, conversion of the precursor N-acylhydrazidines predominantly to the corresponding 1,2,4-triazoles was affected by refluxing in solvents such as m-cresol or by melt cyclocondensation at 250 to 300C. The 1,2,4-triazoles were contaminated with 0.8 to 3.6% of 1,3,4-oxadiazole. When the cyclodehydration of N-benzoyl-(2-pyridyl) hydrazidine was attempted by refluxing in acetic anhydride, the major component in the product was 3-(2-pyridyl)-5-methyl-1,2-4-triazole. Author (TAB)

N70-16341# Atomic Weapons Research Establishment, Aldermaston (England).
THE PENETRATION OF GLASS FIBRE MEDIA BY AEROSOLS AS A FUNCTION OF PARTICLE SIZE AND GAS VELOCITY. PART 1: NONRADIOACTIVE AEROSOLS
J. Dyment May 1969 33 p refs
(AWRE-05/69-PT-1) Avail: CFSTI

Experimental determinations were made of the penetration of a heterogeneous sodium chloride test aerosol through two different fibrous filter media, a medium efficiency fibre mat and a high efficiency glass fiber paper. The experiments covered particle sizes between 0.04 ad 0.5 microns diameter and gas velocities from 2.5 to 50 cm/sec. A maximum value for the penetration versus particle size function was found, varying in position from 0.12 microns down to 0.09 microns with increasing gas velocity. This peak penetration was approximately three times the average test aerosol penetration on a mass basis. It is concluded that the size distribution of the test aerosol was satisfactory for the checking of filter efficiencies. Author (NSA)

N70-16415 California Univ., Los Angeles.
HEAVY ATOM, VIBRONIC AND HOST CRYSTAL PERTURBATIONS ON THE PHOSPHORESCENCE OF MOLECULAR CRYSTALS
Stanley Martin Ziegler (Ph.D. Thesis) 1968 351 p
Avail: Univ. Microfilms: HC $16.00/Microfilm: $4.50 Order No. 69-3930

The polarized phosphorescence spectrum of mixed single crystals of quinoline, isoquinoline, and their halogenated derivatives in biphenyl and durene host crystals was taken at 4.2 K and 77 K. The spectrum of the parent compound, Subspectrum I, was found to persist in the halogenated derivatives. In addition, there appear new bands characteristic of the halogenated molecule, Subspectrum II. Subspectrum I was found to be out-of-plane polarized for most guest molecules in biphenyl. The origin of Subspectrum I is a first-order spin-orbit perturbation which mixes the out-of-plane singlet states with the in-plane emitting triplet state. Dissert. Abstr.

N70-16426*# Kent State Univ., Ohio. Liquid Crystal Inst.
MESOMORPHIC PROPERTIES OF ALKOXYBENZYLIDENE-AMINOACETOPHENONES

Sardari L. Arora, Ted R. Taylor, and James L. Fergason [1969] 10 p refs
(Grant NGR-36-007-025)
(NASA-CR-66885) Avail: CFSTI CSCL 07C

As a part of the program to study the effects of unsymmetrical molecules on the formation of smectic phases, a number of 4-n-alkoxybenzylidene-4'-aminoacetophenones with a chain length in the alkoxy substituent from C1, C3 to C10, C12 and C14 have been synthesized. All the homologs, with the exception of methoxy substituent, show mesophases. Compounds for n-alkoxy chain length of C3 to C8 shown an enantiotropic neumatic and smectic 1 and a monotropic smectic 2. Other homologs with a chain length of C10, C12 and C14 exhibit only an enantiotropic smectic 1. Further, both the smectic phases show focal-conic structure and homeotropic form. No apparent change either in the mechanical or optical properties is observable at the transition temperature of these two phases. Author

N70-16603 Louisiana State Univ., Baton Rouge.
SPECTROSCOPY OF SOME SMALL HIGH SYMMETRY MOLECULES AND OXYANIONS
Thomas Harold Brayden, Jr. (Ph.D. Thesis) 1968 165 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-4454

The approach to the problem involves using certain computational methods and comparing the results obtained with experiment. Some of the shortcomings of the calculational routine are listed and their consequent effect upon the reliability of the calculated values is also discussed. Results of the calculational efforts are used to construct quantitative Walsh energy level diagrams and to determine the charge distributions in the molecules/ions studied. The quantitative diagrams are then compared with published qualitative Walsh energy level diagrams. Development of these qualitative diagrams using group theory is presented. Also, the charge distributions in the various states of the molecules/ions studied are correlated with their lowest energy electronic transitions. Experimental electronic spectra are presented. Dissert. Abstr.

N70-16647 Ohio State Univ., Columbus.
THE VAPOR PHASE, CATALYTIC HYDRATION OF PROPYLENE OXIDE
Larry Everett Wing (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-5001

The primary objective of this work was to study a complex heterogeneous, catalytic reaction and judge its worthiness as a vehicle for carrying out in depth kinetic studies, which could contribute to improved techniques of reactor design for complex reactions. A reactor system was designed and constructed for investigating the vapor phase catalytic hydration of propylene oxide to propylene glycol. The heart of the system consisted of a 1 in. diameter stainless steel reactor tube, which was 34 in. long. Temperature control was maintained to + or − 1 deg C by a boiling Dowtherm E jacket surrounding the reactor. All surfaces in contact with the process stream were stainless steel or glass. Various catalysts were tested, including several ion exchange resins, silica-alumina, aluminum fluoride, and molecular sieves. Only the strongly acidic ion exchange resins and one form of aluminum fluoride catalyzed the formation of propylene glycol. Dissert. Abstr.

N70-16649 New York Univ., N.Y. School of Engineering and Science.
PREDICTION OF THE TEMPERATURE FOR MAXIMUM CONVERSIONS IN CONSECUTIVE REACTIONS FROM DATA OBTAINED AT TWO DIFFERENT TEMPERATURES. PART I. A MECHANISM LEADING TO PROCESS OPTIMIZATION OF THE ACETYLATION OF ORGANIC CHLORIDES, PART 2
I-Der Huang (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-4567

I. Analytical and numerical methods have been used to generalized a linear relationship of temperature with reaction time which yields maximum conversions for complex kinetic systems. Various combinations of consecutive and parallel reactions of orders 0, 1/2, 1, and 2 are tested. The validity of the correlation has been demonstrated by comparing predicted results with calculated data over a wide range of selectivity parameters. Implications are that this correlation theoretically can be applied to other than dual-step reactions. II. The acetylation of organic chlorides with sodium acetate in the presence of various amine catalysts has been studied. The effect on the reaction of the catalyst concentration, the dielectric constant of the solvent, steric characteristics of the catalyst, and the basicity of the catalyst have been investigated. Dissert. Abstr.

N70-16660 New York Univ., N.Y. School of Engineering and Science.
ISOTHERMAL MAGNETOCALORIC OSCILLATIONS IN ANTIMONY
Robert John Vondra (Ph.D. Thesis) 1968 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-4582

Isothermal measurements were made of heat flow oscillations between a heat reservoir and single crystals of antimony in the trigonal-binary plane and in the binary-bisectrix plane at a temperature of 1.8 K, in magnetic fields extending to 20 kG utilizing the method of Long. The samples were connected to the liquid-He bath through a stainless-steel thermal resistance; the sample-to-bath thermal time constant was of the order of 1/2 second. Observed temperature differences between the ends of the thermal resistance provided a measure of the heat flow between the sample and the bath. The magnetic field was varied linearly in time and chart-paper and magnetic tape recordings of the oscillations were converted to digital form at equally space values of inverse magnetic field. The periods of the spectral components were determined by numerical Fourier transform techniques. Pertinent parameters for the Fermi surface were computed from the measured values of the periods. Dissert. Abstr.

N70-16670 Louisiana State Univ., Baton Rouge.
A METHOD OF PREDICTING THE THERMAL CONDUCTIVITY OF SOME HYDROGEN BONDED BINARY SOLUTIONS THAT FORM BIMOLECULAR COMPLEXES
Clayton Phillips Kerr (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-4479

This work deals with binary solutions where the hydrogen bonds formed are bimolecular complexes. The excess thermal conductivity or the deviation of the thermal conductivity from ideality is written in terms of a third order Hermite interpolating polynomial which requires a value of the slope of the excess thermal conductivity function at both ends of the composition range. These slopes were evaluated by assuming the binary solution formed by mixing the pure components is a chemically reacting ternary mixture in chemical equilibrium consisting of both the binary components plus the bimolecular hydrogen bonded complex. The resulting ternary mixture is assumed to form an ideal associated solution. Dissert. Abstr.

N70-16676# Victoria Univ., Wellington (New Zealand). Dept. of Chemistry.
USE OF MOESSBAUER EFFECT IN CHEMISTRY Final Scientific Report
James F. Duncan 2 Sep. 1969 7 p refs
(Grant AF-AFOSR-1236-67)
(AD-694109; AFOSR-69-2425TR) Avail: CFSTI CSCL 7/4

The report presents a brief summary of the accomplishments on the following studies: A theoretical understanding of the relation between isomer shifts, and vibration frequencies was obtained; A more definitive study of the sodium nitroprusside crystal by Mossbauer methods was made than previously reported by other parties; A theoretical understanding and a direct investigation of the effects of magnetic fields on Mossbauer spectra of iron compounds was obtained; The use of Mossbauer Effect in studying reaction mechanisms and kinetics was extended to reactions of kaolinite and ilmenite. Author (TAB)

N70-16692 Virginia Univ., Charlottesville.
PRESSURE DEPENDENCE OF SPECIFIC VOLUMES FOR BIOMACROMOLECULES AND ELECTROLYTES
Paul Farrell Fahey (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-3973

Densities of aqueous solutions have been measured at high pressure by balancing a density dependent buoyant force with a magnetic force. The measurement of the magnetic force involved electronic circuitry that maintained a magnetic float at constant height thereby making the magnetic force measurement tantamount to a current measurement. The instrument (called a magnetic piezometer) so devised for accomplishing this density measurement at high pressure was verified for accuracy on solutions of electrolytes and sucrose whose density-pressure-dependence is known. Having been found reliable, solutions of ribonuclease, and Turnip Yellow Mosaic Virus were studied with the instrument. These species showed no measureable change in their apparent specific volumes between one and 400 atmospheres over a wide range of pH and ionic strength. Dissert. Abstr.

N70-16693 Missouri Univ., Columbia.
STARK EFFECT METHOD OF ELECTRIC FIELD MEASUREMENT
Robert Truman De Woody (Ph.D. Thesis) 1968 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-3375

An analog computer simulation of a Stark cell and the Stark effect is presented, and the results obtained from the simulation are compared with measurements taken from an experimental Stark effect field measuring system. The comparison indicates that the model used for the analog simulation was a good and useful model. Problems of electric field breakdown in low pressure gases and its effect in a Stark cell are discussed. The Stark effect of gases other than ammonia are presented and reviewed. A Stark effect system is proposed that could be used to measure electric field intensity to a resolution of 30 V/m for methyl alcohol. Other gases offer the promise of detecting fields as low as 6.0 mV/m. Dissert. Abstr.

N70-16694 Oregon State Univ., Corvallis.
AN INVESTIGATION OF THE METABORATE MONOMER AND TRIMER IONS IN ALKALI HALIDE CRYSTALS
Charles Ransford Becker (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-455

The infrared spectra of the metaborate monomer and trimer ions in NaCl, KCl, and KBr were studied. These spectra contain bands due to the trimer in solid solution, in a second phase of the appropriate potassium or sodium salt, and perhaps on adjacent lattice sites. The presence of the second phase and its relationship to the infrared bands was confirmed with light scattering experiments. A model for the trimer in solid solution is proposed in which the planar trimer, replaces three next nearest neighbor halide ions that form an equilateral triangle. A normal coordinate analysis which employs a general valence force field predicts eigenvalues which are in fair agreement with the assigned values of the fundamentals. Values for the absorption coefficients of the monomer in KCl and KBr, and the trimer in KCl were determined. Dissert. Abstr.

N70-16704 . Ohio State Univ., Columbus.
PHASE REACTIONS IN THE SYSTEMS MgOSiO2MgF2, MgOGeO2MgF2, and MgOGeO2Mg(OH)2
Stephen Reed Lyon (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-4930

Phase compatibility relations in the systems MgO-GeO2-MgF2 and MgO-GeO2-Mg(OH)2 were investigated by hydrothermal synthesis, solid state reactions or by the quench method. The system Mg2GeO4-MgF2 is a true binary system containing four compounds which are analogs of the naturally-occurring humite minerals. Each of the compounds melts incongruently to a compound of lesser fluorine content. Subsolidus relations were determined down to 700 C. at atmospheric pressure and germanium-humite and -clinohumite are found to dissociate in the solid state. All germanium analogs are characterized optically and unit cell data are refined with a computer indexing program. At high pressures, germanium-chondrodite transforms to Mg2GEO4 (spinel)AND MgF2. Extrapolation of the curve to atmospheric pressure indicates that approximately 580 C. is the low temperature limit of germanium-chondrodite stability; this is in agreement with reactions at very low load pressures. Dissert. Abstr.

N70-16708# Johns Hopkins Univ., Baltimore, Md.
ENERGY TRANSFER IN THE CHEMILUMINESCENCE OF HYDRAZIDES
David Frederick Roswell (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-16,472

Hydrazides have been prepared that separate the energy-generating and light-emitting functions of the molecule. Examples of this type are 5-(9, 10-diphenyl-2-anthrylmethyl)-2,3-naphthalic hydrazide (I) and 4-(acridonylmethyl)phthalic hydrazide (II). The chemiluminescence spectrum of I in aqueous base, hydrogen peroxide, and hemin shows that light emission occurs from both portions of the molecule. Intrinsic emission from the naphthalic portion is observed and compares spectrally to the emission from 2,3-naphthalic hydrazide. The emission from the diphenylanthracene portion of the molecule was shown to arise from intramolecular energy transfer. The rate of this energy transfer was calculated to be 2.4 x 10 to the 7th power/sec. The chemiluminescence quantum yield was found to be .0028 by comparison to luminol. Dissert. Abstr.

N70-16738 Washington State Univ., Pullman.
THERMAL REEMISSION OF NOBLE GASES BURIED IN POLYCRYSTALLINE NICKEL AND IN (100) SINGLE CRYSTAL NICKEL
Allen Le Roy Moen (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-3761

The trapping and thermal reemission of 100 to 500 eV argon, krypton, and helium ions in polycrystalline nickel was studied. The trapping probability of helium was found to be 0.55, 0.22, and 0.39 for 100 eV, 250 eV, and 500 eV respectively; this was from polycrystalline nickel with at most a monolayer of residual gases formed during ion burial. Peaks in the thermal reemission spectra of argon, krypton, and helium from polycrystalline nickel were found, with a surface condition different from that obtained during trapping measurements. The surface condition used for most of the reemission spectra reported was obtained by prolonged heating at 1213 K and possibly included strongly chemisorbed carbon or oxygen. Postbombardment by krypton rearranged buried argon among the various sites available and prebombardment with argon enhanced subsequent helium trapping. Dissert. Abstr.

N70-16743 Duke Univ., Durham, N.C.
SEMICONDUCTORS IN CERTAIN PROTEINS
Karl David Straub (Ph.D. Thesis) 1968 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-3895

While the activation energies for electronic conduction in a wide variety of dry proteins have been thought to be too high for significant electron transport in enzyme catalyzed redox reactions, no enzyme actually involved in these reactions has ever been examined for semiconductive properties. In particular, many of these enzymes have non-heme transition metals which function as integral parts of the enzyme in electron transfer. In these studies, it was considered possible for transition metals to act like impurity centers in inorganic semiconductors and confer on the protein a low activation energy of conduction. It was also considered necessary to reexamine the original observations of conduction in simple proteins for evidences of non-ohmic behavior and time dependence of current which are characteristic of space-charge injection of carriers directly from the electrodes into the conduction bands. This is a common phenomenon in organic semiconductors. Dissert. Abstr.

N70-16758*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
[RESEARCH IN THEORETICAL CHEMISTRY AT THE UNIVERSITY OF WISCONSIN] Semiannual Progress Report, 1 Jul. – 31 Dec. 1969
Joseph O. Hirschfelder 31 Dec. 1969 37 p refs
(Grant NGL-50-002-001)
(NASA-CR-107745; SAPR-15) Avail: CFSTI CSCL 07A

Summaries of research activities and abstracts of reports are presented. Research emphasis was placed on molecular and intermolecular quantum mechanics, theory of statistical mechanics and transport properties, molecular beams and scattering theory, electron spin resonance and quantum mechanical density matrices, and microwave pressure broadening in molecular spectroscopy. Research was also continued on reactive scattering, first order exchange equation for neutral and ionic molecular hydrogen, and energy conversion in biological systems. The reports cover perturbation theory, atomic and molecular collisions, elastic scattering, resonances, binding energies and potentials, dissociation energy and potential of diatomic molecules, and related topics. N.E.N.

N70-16759 Pennsylvania Univ., Philadelphia.
A STUDY OF THE DYNAMICS OF PHOTOCHROMIC SWITCHING IN STRONTIUM TITANATE MATERIALS
Juan Jose Amodei (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-5602

The dynamics of coloration and bleaching of photochromic samples of strontium titanate doped with iron and molybdenum or with nickel and molybdenum were studied experimentally and were analyzed in the light of physical models. The materials are transparent in the ground state, switch to a state with broad visible absorption under irradiation with violet or blue light, and revert back to the transparent state after exposure to light of wavelengths longer than 5000 A or by heat. It is assumed that this occurs via the excitation of electrons to the conduction band and subsequent trapping by the other center. Results suggest that coloration may be accomplished by charge transfer through free holes in the valence band. A study of the time response and intensity dependence of the coloration of these materials was carried out using a Q-switched ruby laser. The results showed that the optically colored samples bleach at a rate proportional to the intensity. Dissert. Abstr.

N70-16771 Ohio State Univ., Columbus.
PHOSPHORUS ION IMPLANTATION IN CADMIUM SULPHIDE
James Thomas Mitchell (Ph.D. Thesis) 1969 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-4940

The technique of ion implantation has been used to produce p-type CdS. The phosphorous acceptor impurity was introduced at relatively low temperatures and the self compensation normally occuring at thermal equilibrium is incomplete. This non-thermal equilibrium technique is of particular interest for doping II-VI compounds that are not amphoteric type when prepared under high temperature processes. They offer good prospects for injection-electroluminescent light sources in the visible region for operation at room temperature. Dissert. Abstr.

N70-16774 Kansas State Univ., Manhattan.
THERMODYNAMICS OF PARTIALLY MISCIBLE SYSTEMS
David Sedgwick Joy (Ph.D. Thesis) 1968 216 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-4161

The feasibility of calculating ternary phase diagrams from binary data was investigated. Phase diagrams were calculated for both a type 1 and a type 2 ternary system. The results of the investigation indicated that a type 2 phase diagram can be calculated with sufficient accuracy for engineering purposes using a two parameter equation to represent the ternary activity coefficients. However, due to the sensitivity of the position of the binodal curve to an error in the estimated activities, a three parameter equation is required to represent the activity coefficients during the calculation of a type 1 phase diagram. A calculation procedure for estimating the activity coefficient parameters from ternary tie line data was developed and tested using synthetic ternary systems. The calculation procedures developed were applied to the published ternary tie line data for several type 1 ternary systems. Dissert. Abstr.

N70-16775 Georgia Univ., Athens.
SOME SOLVENT PROPERTIES OF THIONYL CHLORIDE
Frank Anthony James (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-3459

The initial area of investigation of $SOCl_2$ as a solvent consisted of a qualitative determination of the behavior of $SOCl_2$ toward certain metal oxides. The second area of investigation was the determination of the applicability of the coordination model to the non-aqueous chemistry of $SOCl_2$. Of the minimal results in the first area, the most interesting was the observation that the red solution resulting from the addition of MoO_3 to $SOCl_2$ was reversibly photosensitive, turning light yellow on exposure to visible radiation and returning to its dark red color in the dark. Dissert. Abstr.

N70-16782 Texas Christian Univ., Fort Worth.
F-AGGREGATE OPTICAL ABSORPTION IN LiF AT 3.0 DEG K
Horton Herbert Tracy (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-5607

In addition to the broad band absorption of F-aggregate color centers observable at room temperature, twenty-six discrete peaks appear at low temperature in the region between 3500A and 5234A. All of these absorptions are attributed to (1) zero-phonon interactions in which no energy is absorbed by the lattice during the electronic transition and (2)multiphonon interactions in which 1, 2, 3, etc., phonons of a single frequency are created during the transition. Six prominent zero-phonon lines were observed (at 3908A, 4123A, 4613A, 4747A, 4874A, and 5234A) corresponding to transitions in which the most probable internal symmetry vibrations of the F, N1, N2, and N3 centers are excited. A complete theory was developed to adequately describe both zero-phonon vibronic and multiphonon absorption, as well as to determine the polarization of transitions from absorption data. Dissert. Abstr.

N70-16789 Ohio State Univ., Columbus.
PARTICIPATION AND STERIC EFFECTS OF NEIGHBORING DIVALENT OXYGEN
Robert Walter Begland (Ph.D. Thesis) 1968 161 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-4845

The synthesis and reactions of a number of divalent oxygen containing molecules were studied to obtain information about the steric requirements and reactivity of divalent oxygen. Transannular reactions of ether oxygen and evidence of strain minimization brought about by the introduction of an ether oxygen into a medium-sized ring were observed. When 7,8-dihydro-2H-oxocin-3(4H)-one was heated with hydrochloric acid for several minutes, transannular rearrangement involving participation of ether oxygen was encountered as evidenced by the isolation of 5-(3-chloropropyl-dihydro-3(2H)-furanone in good yield. Several other oxocin derivatives were prepared and treated with acid in order to study the various facets of this transannular reaction. Dissert. Abst.

N70-16794 Texas Univ., Austin.
RESOLUTION OF THE HIGH- AND LOW-SPIN STATES OF SOME FE(III) TRIS NN-DIALKYLDITHIOCARBAMATES
John Craig Carrell (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-5125

The magnetic moment of these complexes is intermediate between the high-and low-spin value, tending toward the low-spin value at low temperatures. Mossbauer spectra of the undiluted complexes at temperatures where either the high-or low-spin state is dominant exhibit a quadrupole splitting of less than 1 mm./sec., indicating a single chemical species of intermediate character. This suggests that an interaction between the two spin states occurs at a rate faster than 10 to the 9th power per sec. By diluting the compounds on silica gel the individual spin states were resolved and in addition it was observed that the population of the high-spin state rather than the low-spin state increased as temperature decreased for the methyl and isobutyl complexes. It is suggested that the decrease in magnetic moment is due to the combined effects of antiferromagnetism and paramagnetism rather than being due to an increase in population of the low-spin state at low temperature. Dissert. Abstr.

N70-16818 Virginia Univ., Charlottesville.
STUDIES IN THE FARADAY EFFECT: PART 1: TROPYLIUM CATION. PART 2: SPIN-FORBIDDEN BANDS OF d(3) IONS ORIENTED IN A CRYSTALLINE LATTICE AT SITES OF D SUB 3 SYMMETRY AT LOW TEMPERATURES
Adam Burke Ritchie, Jr. (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-4002

MDC measurements were carried out on the 275 m micron orbitally forbidden transition of the tropylium cation and the results compared with theory, in which a vibronic intensity mechanism was assumed. A complete symmetry crystal field calculation was performed and the results used to interpret the MCD spectra of Cr(ox)3/3 and ruby at low temperatures. Dissert. Abstr.

N70-16826 Iowa State Univ. of Science and Technology, Ames.
GAMMA-IRRADIATION EFFECTS IN SINGLE-CRYSTALLINE BARIUM TITANATE
John Joseph Keating (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-4247

Two test groups of crystals were utilized. One group was etched in phosphoric acid at 145 C prior to being irradiated. The second group was irradiated in the as-grown condition. Experimental work performed with gamma dose as the variable included development of the ferroelectric hysteresis loop, measurement of the optical absorption spectrum in the wavelength range of 0.43 to 0.70 microns, and the taking of photomicrographs of the domain structure. The etched crystals were irradiated in the poled condition to a maximum dose of 1.60 × 10 to the 9th power rad. The unetched crystals were irradiated to a maximum dose of 2.91 × 10 to the 8th power rad. With initial irradiation, the polarization reversal process is enhanced as the remanent polarization increased and the coercive field decreased. The unetched crystals are thus found to be much more sensitive to Co-60 gamma radiation than are the etched crystals. Dissert. Abstr.

N70-16828 Ohio State Univ., Columbus.
HIGH TEMPERATURE REACTIONS AND PHASE EQUILIBRIA IN THE STRONTIUM OXIDE-ZIRCONIUM SYSTEM
Wilbur Cameron Simmons (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-4972

An investigation of the strontium oxide–zirconium oxide system by X-ray diffraction, differential thermal analysis, thermogravimetric, and metallographic analysis has lead to the construction of the equilibrium phase diagram. The compound SrZrO3 was found to be stable from 85 K to above 2000 C and its reported melting point is above 2600 C. The Sr3Zr2O7 compound was found to be stable from room temperature to 2280 C where it decomposed in a peritectic reaction forming SrZrO3 plus liquid. The SrZrO3 was found to be in equilibrium with monoclinic zirconia from room temperature to 1110 C, tetragonal zirconia from 1110 C to 2080 C, and cubic zirconia from 2080 C to the eutectic at 2290 C. The eutectic composition was found to be near 27.5 mole % SrO. Only the center core of the sample was used and the zirconium: strontium ratio was monitored throughout the investigation by X-ray fluorescence analysis. Dissert. Abstr.

N70-16840# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
ABSOLUTE CHEMILUMINESCENT REACTION RATES FOR EMISSION OF THE 0 SUB 2 HERZBERG BANDS IN OXYGEN AND OXYGEN-INERT GAS AFTERGLOWS, JULY 1968-APRIL 1969
Robert J. McNeal and Stephen C. Durana 15 Jul. 1969 29 p refs Revised
(Contract F04701-69-C-0066)
(AD-694062; TR-0066(9260-01)-3; SAMSO-TR-69-270) Avail: CFSTI CSCL 7/4

Chemiluminescent reaction rates for emission of the O2 Herzberg bands in the O2 and O2 + He or Ar afterglows have been measured in a discharge-flow system. Absolute intensities were measured between 260.0 nm and 420.0 nm at 0.5-nm resolution with a scanning spectrometer, and oxygen atom densities were determined by NO2 titration. Intensities were obtained as a function of atom density, O2 pressure, and partial pressures of added nonreactive gases. The integrated intensity of the Herzberg band system is proportional to the square of the oxygen concentration and independent of O2 pressure between 1 and 10 torr. The A triplet Sigma(u)(+) state of O2 is quenched by ground state O2, and the Herzberg bands are stronger in mixtures of O2 with He or Ar than in pure O2. The vibrational population distribution is shifted to lower vibrational levels of O2 the square of the oxygen concentration in the O2 - inert gas mixtures than in pure O2. Author (TAB)

N70-16843 Carnegie-Mellon Univ., Pittsburgh, Pa.
A STUDY OF INDIVIDUAL PARTICLE TRAJECTORIES IN ELECTROSTATIC PRECIPITATION
William G. Gensler (Ph.D. Thesis) 1968 164 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-3939

A stroboscopic, photographic system was developed and applied to the movement of particles with diameters ranging from 5

to 177 microns. The experiments were directed to the observation of position, velocity, acceleration, shape, orientation and rotation in the interelectrode region as well as at the surface of the passive electrode in a model precipitator. The mean and standard deviation of the transverse and longitudinal velocity for 5-10 micron diameter particles were determined. The fluctuating velocities were found to be isotropic. There was no increase in the intensity of turbulence when corona conditions were imposed. The use of a plenum at the entrance to the electrode duct reduced the level of turbulence 50% over the turbulence level with an expansion type entrance duct. The vast majority of particles exhibited no rotation. No preferential orientation was observed. Dissert. Abstr.

N70-16846 Texas Christian Univ., Fort Worth.
ABSORPTION SPECTRA OF MERCURY AND CADMIUM IN SOLID RARE GASES
Robert Bartlett Merrithew (Ph.D. Thesis) 1968 57 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6603

Rare gas to metal atom molar ratios of 20:1 to 650:1 were used at formation temperatures of 16.3 to 30.0 K. The electronic transitions investigated were the 2536 A line of mercury and the 2288 A line of cadmium. The absorption spectra of the metal atoms in xenon exhibited multiplets. These multiplets were explained by assuming one component caused by isolated atoms and other components caused by atoms at nonnearest-neighbor sites in the solid. The energies of the interacting pairs were obtained from diatomic potential curves of Hg2 and Cd2. The assignment of the isolated component was confirmed in the case of cadmium by selective bleaching of components. The absorption spectra of mercury in krypton displayed poorly resolved spectra that were explained in the same manner as mercury in xenon. The absorption spectra of mercury in argon displayed two wide bands that were explained by assuming one band was caused by isolated atoms and atoms at nonnearest-neighbor sites in the solids; the other components are caused by mercury dimers. Dissert. Abstr.

N70-16853 Utah Univ., Salt Lake City.
KINETIC STUDY OF THE SURFACE AREA CHANGE OF HEXANITROAZOBENZENE DURING AGING
Gary Elvan Korth (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: HC $6.20/ Microfilm $3.00 Order No. 69-4175

Surface area measurements of hexanitroazobenzene, HNAB, were performed using a sorptometer. The decrease in surface area with aging at various temperatures below the thermal decomposition temperature showed a log time dependence. The surface area decreased very rapidly for the first 35 to 40 minutes and then either stopped or continued at a much slower rate. The majority of the surface area, which was initially 2.4 m2/gr, was due to many small cracks formed by thin platelets which were agglomerated into larger particles of approximately 20 microns. The surface area decrease is dependent on the rate of material adsorbing in the cracks and was found to be due to "fissure adsorption," which is dependent on the radius of curvature at the bottom of the crack, i.e., the width of the fissure. The range of crack widths active in filling was found to be a function of temperature, and the number of active cracks to be an exponential function of temperature. Dissert. Abstr.

N70-16858# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.
PHOTOIONIZATION WITH ATOMIC BEAMS. PART 1: ZINC ATOMS BETWEEN 247 AND 1242 ANGSTROMS. PART 2: CADMIUM ATOMS BETWEEN 8.99 AND 83eV AND ZINC ATOMS BETWEEN 27.35 AND 66 eV
Halstead Harison, Richard I. Schoen, Keith E. Schubert, and R. B. Cairns Dec. 1968 77 p refs
(AD-694560; DI-82-0779) Avail: CFSTI CSCL 7/4

The wavelength dependences of the photoionization cross sections of zinc atoms have been measured with a modulated atomic beam and pulsed, dispersed vacuum-ultraviolet radiation. The photoions were mass analyzed, counted, and digitally demodulated. The energy dependences of the photoionization cross sections to produce Cd(+), Cd(++), and Zn(++) have been measured with modulated atomic beams and pulsed, dispersed vacuum-ultraviolet radiation. Author (TAB)

N70-16861 Florida Univ., Gainesville.
SOLUBILITY OF NONPOLAR GASES IN POTASSIUM HYDROXIDE SOLUTIONS
Satyendra Kumar Shoor (Ph.D. Thesis) 1968 182 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-5401

Measurements are reported for a partial pressure of one atmosphere of solute gas. The temperature range covered is 25–100 C, and the electrolyte concentration range considered is 0–60 wt. % KOH. The dissolved gases studied are composed of roughly spherical molecules of various sizes and include helium, argon, oxygen, hydrogen, sulfur hexafluoride, methane and neopentane. The experimental method involved stripping the dissolved gas from solution using a carrier gas stream, and subsequent analysis of this stream by gas chromatography. For all the gases studied the solubility falls off very rapidly with rising electrolyte concentration; thus for oxygen in 50 wt. % KOH at 25 C the solubility is approximately 1% of the value for pure water. From the experimental measurement, calculated values of activity coefficients, heats of solution, energies of solution, and entropies of solution are obtained as a function of KOH concentration, temperature and solute gas. Dissert. Abstr.

N70-16903 National Lending Library for Science and Technology, Boston Spa (England).
MECHANISM OF THE VAPOUR-PHASE NITRATION OF ALKANES BY NITROGEN PEROXIDE
V. Y. Shtern 10 Sep. 1969 34 p refs Transl. into ENGLISH from Khim. Kinet. Tsepnye Reakts., Inst. Khim. Fiz. Akad. Nauk SSSR (Moscow), 1966 p 286–322
(NLL-MINTECH-T-6031-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

Three types of reaction under different rate conditions are examined experimentally and the mechanism of reaction discussed, particularly the conditions for chain formation, branching and chain discontinuity. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-16526*# Stanford Univ., Calif. Radioscience Lab.
NONDUCTED VLF PROPAGATION IN THE MAGNETOSPHERE
Fernando Walter Oct. 1969 155 p refs
(Contract NAS5-3093; Grant NsG-020-008; Contract N00014-67-A-0112-0012; Grants NSF GA-1151; NSF GA-1485) (NASA-CR-107614; SU-SEL-69-061; TR-3418-1) Avail: CFSTI CSCL 17B

Evidence for nonducted VLF propagation between conjugate hemispheres has been found in records from the broadband VLF receivers aboard the polar satellites OGO 2 and OGO 4. The

nonducted signals are received in the ionosphere between 47 deg and 56 deg. invariant latitude. They have never been observed on the ground and include natural whistlers and fixed-frequency signals from Omega transmitters. In a frequency – time spectrogram, these nonducted whistlers appear as rising tones with a lower cutoff frequency in the approximate range of 5 to 8 kHz. A train of WT whistlers exhibits a nearly constant lower cutoff frequency which is equal to the maximum value of the lower hybrid resonance (LHR) frequency above the satellite, and an upper cutoff frequency that decreases with increasing satellite latitude. Fixed frequency Omega signals exhibit two features that are not apparent in the natural whistlers: an enhancement of signal strength and a Doppler shift that increases with latitude and may reach hundreds of Hertz. Author

N70-15526# Aerospace Corp., El Segundo, Calif. Electronics Div.

AN APPLICATION OF A COLORED NOISE KALMAN FILTER TO A RADIO-GUIDED ASCENT MISSION, AUGUST 1966 - MARCH 1969

Donald J. Johnson 31 Jul. 1969 17 p refs

(Contract F04701-69-C-0066)

(AD-695455; TR-0066(5306)-2; SAMSO-TR-69-316) Avail: CFSTI CSCL 9/4

A set of general sequential filter equations is derived for nonlinear system dynamics and a nonlinear observation model, but is obtained with the assumption of a linear estimator. These equations, which are based upon previously developed formulas, include the colored measurement noise statistics and the statistics of nonestimated model parameter errors. Several simulations made with this filter are compared with the simulation results of an estimation procedure constructed with the utilization of the standard white noise assumptions. The difference between the white noise filter results and the colored noise filter results is found to be minimal. Instability occurred when the statistics of the effective exhaust velocity in the acceleration model were not properly accounted for. Author (TAB)

N70-15562*# Hughes Aircraft Co., Culver City, Calif.

AAP DATA RELAY TERMINAL DESIGN STUDY Progress Report, 14 Oct. – 16 Dec. 1969

Leon M. Gould 16 Dec. 1969 50 p

(Contract NAS w-1982)

(NASA-CR-107652; PR-2) Avail: CFSTI CSCL 17B

After an initial design review, several tradeoff studies were completed and a terminal baseline design was established. Work on integration of the Data Relay Terminal (DRT) into the Saturn Workshop (SWS) was terminated when it was established that the DRT would not be incorporated into the SWS. Two possible DRT configurations have been included in the baseline design, the principle differences between them being the length and layout of the antenna boom and the location at which the boom is attached to the SWS. It was established that communications via the DRT employ one carrier on the up-link and two carriers on the down-link. Simultaneous transmission of multiple low data rate digital telemetry signals is accomplished by digital multiplexing into a single data stream at 72,000 bits per second. Author

N70-15590# Naval Ordnance Lab., White Oak, Md.

OPTIMUM AND SUB-OPTIMUM COMPRESSION OF SECOND ORDER MARKOV DATA

Arthur J. Buckheim 10 Jun. 1969 173 p refs

(AD-692379; Noltr-69-46) Avail: CFSTI CSCL 9/6

A new and more realistic model for telemetry data has been developed and analyzed. The model is Markovian in nature due to each data sample's statistical dependence on previous sample values and activity state. The conditional mode and conditional mean predictors are derived from the data model and shown to be optimum compression techniques. For the optimum techniques, expressions are developed for the error probability distribution and the redundant sample run length distribution as a function of aperture width. Experimental results confirm the superiority of the optimum techniques and also indicate that of the two conventional methods, the fan technique is preferred for small apertures whereas the zero order predictor is more efficient for large aperture processing. Author (TAB)

N70-15604*# California Univ., La Jolla. Dept. of Applied Physics and Information Science.

THE APPLICATION OF SIGNAL DETECTION THEORY TO OPTICS Progress Report

Carl W. Helstrom 15 Dec. 1969 20 p refs

(Grant NGL-05-009-079)

(NASA-CR-107615) Avail: CFSTI CSCL 17H

Estimation of parameters of incoherently radiating objects, detection of optical signals of known phase, and computation of coefficients for discrete-Fourier-transform filters are presented. Author

N70-15625# Stanford Univ., Calif. Electronics Lab.

OPTICAL DATA PROCESSING WITH APPLICATION TO RADAR PARAMETER ESTIMATION Final Technical Report, Sep. 1964 – Dec. 1968

C. S. Weaver, S. D. Ramsey, J. W. Goodman, A. Rosie, and A. Silvestri Jun. 1969 90 p ref

(Contract AF 33(615)-3589)

(AD-694588; SU-SEL-69-030; TR-2306-2) Avail: CFSTI CSCL 17/9

The ease with which an optical system can achieve an extremely large time-band-width product makes optical filters and autocorrelation function generators attractive for signal detection and parameter estimation when signal-to-noise ratios are very low. The theory of autocorrelation function generation is given, and the principles of a new optical filter that overcomes the severe positioning requirements of conventional optical filters are described. The relationship between the signal amplitude and matched-filter impulse response amplitude is discussed, and a method for reducing a noise component that is common to all optical filters is given. A matched filter was constructed and used to detect a radarlike pulse when the signal-to-noise ratio was -40 dB. A digital computer, used with an optical system, to filter time signals was found to be as accurate as an all-digital system, but a significant reduction in computation time was realized. The theory of an optical-digital filter is presented; also, the theory of distortions caused by nonlinearities in optical filters and autocorrelation function generators is developed in an appendix. A radar pulse parameter estimator that uses an autocorrelator and another that uses a bank of matched filters are proposed. Both estimators may be realized with optical techniques. Author (TAB)

N70-15642*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NASA MINITRACK INTERFEROMETER REFRACTION CORRECTIONS

P. E. Schmid Oct. 1969 45 p refs

(NASA-TM-X-63787; X-551-69-434) Avail: CFSTI CSCL 17H

The NASA Minitrack interferometer system is an accurate, reliable and proven spacecraft tracking system. This report reviews the influence of the Earth's atmosphere upon Minitrack calibration and spacecraft tracking. It is believed that this review will aid the orbit computation engineer in selecting those refraction correction procedures which will assure maximum orbit computation accuracy whenever an interferometer such as the Minitrack system is employed. Author

N70-15657*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PERFORMANCE EVALUATION OF FRAME-SYNCHRONIZATION CODES FOR PCM TELEMETRY

Jesse L. Maury and Frederick J. Styles Aug. 1967 790 p refs

(NASA-TM-X-63782; X-562-67-438) Avail: CFSTI CSCL 17B

This document presents the results of a study to measure the performance of any binary bit pattern, from 7 to 40 bits long, as a spacecraft telemetry frame-synchronization code. A computer program, the Evaluator, was written to analyze code performance in terms of percent of data lost and mean time to acquire frame synchronization as a function of telemetry frame length and bit-error rate of the received telemetry signal. This document defines the problem, describes the frame-synchronization system, outlines its mathematical analysis, and specifies the Evaluator's output. The Appendix contains the graphical output of the Evaluator for the GSFC PCM Telemetry Standard Codes. This information is intended to aid the telemetry format designer in optimizing his selection of frame-sync code length and the equipment operator in determining the best errors-allowed setting for the ground-station frame synchronizer, based on quantitative evidence rather than the heretofore used best guess. Author

N70-15672# Federal Aviation Administration, Atlantic City, N.J.

TEST AND EVALUATE DUAL DIVERSITY FOR AIRPORT SURVEILLANCE RADARS (ASR) Final Report

Domenick L. Offi Dec. 1969 54 p refs

(NA-69-50; RD-69-56) Avail: CFSTI

A frequency diversity modification was developed for the National Aviation Facilities Experimental Center (NAFEC) Airport Surveillance Radar-5 (ASR-5) test bed. The modified system was evaluated to determine the extent of performance improvements realized with this technique. Radar system tests indicated the modification had little effect on normal single channel maintainability, and resulted in an improvement in reliability because of an increase in available radar service. Detection capability tests showed a significant increase in probability of detection for both the analog system, and for the Radar Video Data Processor (RVDP) operating in conjunction with the ASR-5. It was recommended that a prototype frequency diversity modification, similar to that employed in these tests, be considered for field implementation. Author

N70-15700# California Inst. of Tech., Pasadena. Antenna Lab.

INVESTIGATIONS IN THE THEORY OF ELECTROMAGNETIC SCATTERING FROM EXPANDING DIELECTRIC OBSTACLES

Ronald J. Pogorzelski Sep. 1969 97 p refs

(Grant AF-AFOSR-68-1400)

(AD-695828; TR-50; AFOSR-69-2051TR) Avail: CFSTI CSCL 20/14

An equation for the reflection which results when an expanding dielectric slab scatters normally incident plane electromagnetic waves is derived using the invariant imbedding concept. The equation is solved approximately and the character of the solution is investigated. Also, an equation for the radiation transmitted through such a slab is similarly obtained. An alternative formulation of the slab problem is presented which is applicable to the analogous problem in spherical geometry. The form of an equation for the modal reflections from a nonrelativistically expanding sphere is obtained and some salient features of the solution are described. In all cases the material is assumed to be a nondispersive, nonmagnetic dielectric whose rest frame properties are slowly varying. Author (TAB)

N70-15767*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

VLF MEASUREMENTS OF THE POYNTING FLUX ALONG THE GEOMAGNETIC FIELD WITH THE INJUN 5 SATELLITE

Stephen R. Mosier and Donald A. Gurnett Jun. 1969 41 p refs

(Contracts NAS5-10625; NAS1-8141; NAS1-8144; NAS1-8150; Grant NGR-16-001-043; Contract Nonr-1509(06))

(NASA-CR-107681; AD-691831; Rept-69-27) Avail: CFSTI CSCL 04A

The direction of the Poynting flux, up or down the geomagnetic field, has been determined for several types of VLF radio noise phenomena observed with the Injun 5 satellite, thereby providing information about the source region of these waves and their propagation in the ionosphere. Determinations of the Poynting flux direction of proton whistlers show that they are propagating up the geomagnetic field lines in accordance with the accepted theory of proton whistler propagation. Thus providing a good check on the experimental technique. Initial measurements are presented on the Poynting flux direction of the ELF hiss, periodic emissions, VLF hiss, and chorus. Of particular interest is a new type of VLF emission called a saucer which is found to be propagating upward from a source below the satellite. A qualitative explanation of the frequency-time shape of this new type of emission is presented. Author (TAB)

N70-15768*# Stanford Univ., Calif. Radioscience Lab.

INTERPRETATION OF VLF SIGNALS OBSERVED ON THE OGO-4 SATELLITE

Rege Romeu Scarabucci Oct. 1969 169 p refs

(Contract NAS5-3093; Grant NGR-020-008)

(NASA-CR-107654; SU-SEL-69-065; TR-3418-2) Avail: CFSTI CSCL 17B

The main purpose is to present and interpret measurements of very low frequency signals observed with the low altitude, polar orbiting, OGO-4 satellite. The interpretations of the measurements are based on amplitude and spectrum analysis of the received signals as well as on the related position of the satellite. The phenomena to be discussed are observed on nearly all revolutions of OGO-4. The present study is mainly concerned with signals generated on the ground by lightning strokes and by VLF transmitters. This research may also be classified as a global study of very low frequency propagation in the ionosphere and in the magnetosphere of the earth. It includes the general problem of excitation of waves through the lower ionosphere under different conditions and the characteristics of propagation inside the anisotropic plasma above the earth. The study covers a variety of situations, including signals received when OGO-4 is relatively close to the ground sources and signals received at low, middle, and high latitudes. The differences between daytime and nighttime propagation are also included. Author

N70-15793*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SCATTERING OF WAVES FROM A ROUGH LAYER

William D. Boles Sep. 1969 192 p refs Prepared by Kansas Univ.

(Contracts NAS9-7175; DAAK02-68-C-0089; Grants NSF GK-1153; NSF GK-11381)

(NASA-TM-X-62579; CRES-TR-118-19) Avail: CFSTI CSCL 20N

The applications of the acoustic results to electromagnetic scatter are considered and the limitations are pointed out. A theory is developed for the backscattering of acoustic waves from a semi-transparent layer having either the front or the rear face randomly rough and the other interface plane. It was found that, if the roughness is of the order of the incident wavelength or greater, the power returned from the two faces could be determined independently and added together to obtain the total power return from a layer. An extensive experiment was conducted using layers with identical roughness and varying thicknesses to compare with the theory developed. Each layer was investigated under four conditions: rough front and perfectly reflecting smooth rear, rough front and smooth rear with both reflection coefficients of the same order of magnitude, smooth front and perfectly reflecting rough rear, and smooth front and rough rear with both reflection coefficients

nearly the same. The results of the experiment show that a single frequency system cannot detect the presence of a layer unless the returns from the two interfaces can be resolved in range. Author

N70-15799# Navy Underwater Sound Lab., New London, Conn.
DISTORTION OF SOME "SQUARISH PULSES" IN A CONSTANT GRADIENT MEDIUM
David H. Wood 8 Sep. 1969 12 p refs
(AD-696088; USL-1037) Avail: CFSTI CSCL 17/1

The exact responses to some squarish pulses from a point source are found by using an integral representation due to R. R. Goodman. The resulting distortion is shown to depend only on the dimensionless parameter travel time multiplied by the magnitude of the gradient. Author (TAB)

N70-15840# Army Medical Research Lab., Fort Knox, Ky.
A STOCHASTIC MODEL OF SIGNAL DETECTION UNDER CONDITIONS OF TEMPORAL UNCERTAINTY Progress Report
James N. Cronholm 24 Jun. 1968 41 p refs
(AD-693868; USAMRL-782) Avail: CFSTI CSCL 9/4

The report describes a reformulation of the problem of analyzing detection data obtained when signal presentation times follow an arbitrary intersignal interval distribution. The approach is based on revised definitions of hits, misses, correct negatives, and false positives which are natural in this situation. It permits the construction of functions analogous to the isosensitivity and isobias curves of classical detection theory directly from observed time series of signals and responses. A model of the processes underlying the generation of signal-response time series is described, and the probability densities of interval durations associated with hits, misses, correct negatives, and false positives are presented. The areas under these distributions, and two related densities, are interrelated. An expression for the expected number of responses per signal is given along with suitable estimation procedures. The proposed model incorporates arbitrary intersignal interval and response latency distributions. These were replaced respectively by exponential and triangular distributions in a test of the model using data obtained from a simple auditory detection experiment in which signal rate and intensity were varied. Author (TAB)

N70-15982*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-59, VOLUME 2 FOR THE PERIOD 1 JULY-31 AUGUST 1969. THE DEEP SPACE NETWORK
30 Sep. 1969 173 p refs
(Contract NAS7-100)
(NASA-CR-107621; JPL-SPS-37-59-Vol-2) Copyright. Avail: CFSTI CSCL 17B

The development of the Deep Space Network (DSN), designed for two-way communications with unmanned spacecraft at planetary distances is reported. Included are: (1) description of the DSN tracking system; (2) tracking and data acquisition requirements, commitments and support for Pioneer 9, Mariner Mars 69, and 71; (3) research in tracking, navigational accuracy, communications, and support technology; (4) facility development and implementation; and (5) space flight operations and facilities operations. F.O.S.

N70-15985# Naval Postgraduate School, Monterey, Calif.
BLOCKING PROBABILITIES IN SMALL COMMUNICATION NETWORKS
John Mc Grath (M.S. Thesis) Dec. 1968 53 p refs
(AD-696068) Avail: CFSTI CSCL 9/4

Models are derived for small communications networks. Blocking probabilities are obtained for 2 terminal k-channel systems and compared with simulation results. Author (TAB)

N70-15997# Weapons Research Establishment, Salisbury (Australia).
TABLES OF RADAR CROSS SECTIONS OF SPHERES
J. L. Whitrow Jun. 1969 27 p refs
(PAD-166) Avail: CFSTI

When the radar cross section of an object is measured, it is normal practice to make the measurement relative to some standard target whose cross section is known. The most commonly used target is a sphere as it is the only simple finite sized obstacle which yields an exact solution in terms of analytic functions. Tables of radar cross sections of spheres with radii from 1·0 to 9·99 wavelengths are presented in this paper, together with sufficient supplementary tables for most calculations associated with cross sections of spheres. In addition a section deals with the surface accuracy required for a sphere if it is to be used as a standard. Author

N70-16118# Weapons Research Establishment, Salisbury (Australia).
A TELEMETRY SYSTEM FOR SMALL PROJECTILES
J. R. Groves Apr. 1969 23 p refs
(HSA-147) Avail: CFSTI

A telemetry set for use in airborne vehicles about 2-1/2 inches diameter and 6 inches long is described. The sender has three channels which measure missile pitch, roll and yaw attitudes, and it could readily be developed to include up to eight channels. A ground based demodulator has also been designed to operate in conjunction with the sender, forming a simple telemetry system capable of covering a range of several miles. The airborne components have survived shock loads of 1200 g. Author

N70-16351*# Stanford Univ., Calif. Stanford Electronics Labs.
DIGITAL SPECTRAL ANALYSIS OF BISTATIC-RADAR ECHOES FROM EXPLORER 35
G. Leonard Tyler Oct. 1969 22 p refs
(Contract NAS5-9347)
(NASA-CR-107730; SU-SEL-69-063; TR-3609-5) Avail: CFSTI CSCL 17I

Bistatic radar echoes from Explorer XXXV have been received using a 150 ft. dish antenna. Analog tape recordings are used to preserve narrow band receiver outputs for subsequent digital spectral analysis. With a proper choice of system parameters dynamic ranges in excess of 60 db are achieved. Use of the Cooley-Tukey algorithm in a real time computer program permits the computation of Fourier coefficients for a slightly greater than 1 KHz data bandwidth with 1 hz resolution. A subsequent operation combines sets of these coefficients to form reliable spectral estimates. Author

N70-16426 Advisory Group for Aerospace Research and Development, Paris (France).
OBLIQUE IONOSPHERIC RADIOWAVE PROPAGATION: FREQUENCIES NEAR THE LOWEST USABLE HIGH FREQUENCY
T. B. Jones, ed. (Leicester Univ.) Slough, Engl. Technivision Serv. Jun. 1969 548 p refs Held Leicester, Engl., 1969
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Conference proceedings centered on various aspects of propagation on frequencies near the LUF, such as the basic physical properties of the lower ionosphere and problems of establishing reliable prediction services. For individual titles, see N70-16427 through N70-16464.

N70-16430 University Coll. of Wales, Aberystwyth. Dept. of Physics.
RADIO STUDIES OF THE LOWER IONOSPHERE

W. J. G. Beynon *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 25–33 refs (See N70-16426 05-07)
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Studies of the ionospheric absorption of short waves and more particularly absorption in the D- and lower E- regions are presented. The LUF is governed by the electron density and collisional frequency in the lower parts of the ionosphere at which levels the main absorption of short radio waves takes place. The practical LUF involves considerations not only of the field strength of the net signal but also of the noise received on a particular frequency and both of these depend upon the absorption of radio signals by the ionosphere and upon the variation of such absorption with frequency. The complete solution of the signal intensity aspect of the problem would mean that for radiation from a transmitter of known characteristics it should be possible to calculate the field intensity at any distant point. The influence of ionospheric absorption is not the only factor to be considered, account must also be taken of spatial attenuation. Author

N70-16431 Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany).

DIURNAL AND SEASONAL VARIATION OF ABSORPTION IN THE IONOSPHERE DETERMINED FROM FIELD STRENGTH RECORDING AT 2.6 Mc/s

Heinrich Schwentek *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 35–38 refs Submitted for publication (See N70-16426 05-07)
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Since 1956, measurements of absorption in the ionosphere have been made by means of field strength recordings on the circuit Norddeich-Lindau in Germany (frequency 2.61 Mc/s). The diurnal variation of absorption L has been determined for nearly all days in 1961 until 1965. The sun's zenith angle was found. The distribution shows a large maximum between 0.7 and 0.8 and a small one between 0.9 and 1.0. The annual variation of absorption can be described. Finally, it is pointed out that the amount of winter anomaly absorption is dependent on time in winter, frequency, and geographical latitude appearing between about 35 deg and 70 deg. Author

N70-16432 Council for Scientific and Industrial Research, Johannesburg (South Africa). National Inst. for Telecommunications Research.

MEASUREMENTS OF ABSORPTION AT OBLIQUE INCIDENCE OVER A 1000 km PATH, AND THEIR INTERPRETATION IN TERMS OF A MODEL OF THE LOWER IONOSPHERE

R. W. Vice *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 39–48 refs (See N70-16426 05-07)
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Measurements made during the International Geophysical Year of pulse amplitudes and delays, at the frequency 10.74 MHz over a 1000 km transmission path between Johannesburg and Salisbury are described. Particular attention was paid to two modes of propagation, the first of which was identified as a single-hop E layer reflection, and the second as a single-hop F reflection, probably changing to high angle E reflection at zenith angles approaching 0 deg. The measured values of absorption were compared with values calculated for a model ionosphere based on measurements at vertical incidence, and it was found that the observations could be reasonably well accounted for in terms of the model. Author

N70-16433 Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany).

MEDIUM WAVE REFLECTION PROPERTIES OF THE IONOSPHERE ABOVE TSUMEB

W. Elling *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 49–50 Presented at DRTE/AFCRL Conf. on Ground Based Radio Wave Propagation Studies of the Lower Ionosphere, Ottawa, Can., Apr. 1966 (See N70-16426 05-07)
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A short survey of the results of medium wave pulse echo soundings at vertical incidence, carried out at Tsumeb, South West Africa, will be given. Tsumeb is a very suitable place for medium wave propagation experiments, since the interference level is very low. The measurements at Tsumeb covered two periods, namely one during the sunspot maximum in 1957–58 and a second period during the sunspot minimum in 1964–65. Each period lasted about 8 months. From pulse amplitude measurements, using the constant gain technique, the apparent reflection coefficients were derived. The loss coefficients were calculated. The loss coefficients were determined at different fixed frequencies in the range from 250 to 1400 kc/s. Nighttime measurements of ordinary waves were made in 1957-58. In 1964-65 the amplitudes of ordinary and extraordinary waves were recorded during daytime and nighttime. In addition, sweep frequency ionograms, ranging from 250 to 4000 kc/s, were recorded. Author

N70-16434 Environmental Science Services Administration, Boulder, Colo. Inst. for Telecommunication Sciences and Aeronomy.

THE PRACTICAL PREDICTION OF LOWEST USEFUL FREQUENCIES

George W. Haydon *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 51–60 (See N70-16426 05-07)
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The bases for predicting the lowest useful frequency for high frequency sky wave communication are outlined, and the evolution of criteria used to select lowest useful frequencies is reviewed. Prediction methods using electronic computers are emphasized. Author

N70-16435 Stanford Research Inst., Menlo Park, Calif.

PROPAGATION CHARACTERISTICS AND COMMUNICATION SYSTEM PERFORMANCE

D. L. Nielson *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 61–70 refs (See N70-16426 05-07)
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The the acronyms MUF (maximum usable frequency) and LUF (lowest usable frequency) have traditionally been used in describing the spectrum limits of a particular propagation path, limits based on signal strength or signal-to-noise ratio. Generally, a more accurate gauge of system performance is error rate. But since error rate and therefore usability are very system-dependent, MUF and LUF can be defined only in a restricted sense, to describe the combined properties of a specified communication system and the propagation path. This chapter draws on recent developments in communication system modeling to outline a method whereby these terms may acquire a strict meaning either in a measurement sense, as with oblique sounders, or in prediction techniques. The method employs a two-dimensional power spectral density function known as the scattering function. General procedures are outlined for arriving at the spectrum of frequencies that can meet or exceed a given signal quality. This quality is measured in binary error rate and defined for a specific system by such parameters as signal-to-noise ratio, multipath, Doppler spread, and acceptability threshold. Author

N70-16436 Government Communications Hq., Cheltenham (England).
SOME OBSERVATIONS OF SIGNAL STRENGTH OF SKYWAVES AND NOISE LEVELS NEAR THE LUF WITH REFERENCE TO MODES OF PROPAGATION
R. F. Treharne *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 71–82 refs (See N70-16426 05-07)
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A comparison of signal strength and predicted modes of propagation over moderate distances on frequencies moderately close to the LUF suggests that the changing mode structure plays an important part. The angle of arrival of these modes may vary over a very wide range during the day. This suggests that the vertical polar diagrams of aerials used for such radio paths should receive careful attention. Observations of noise level using aerials of different polarization and directivity at various distances from centres of population are described. Author

N70-16437 Government Communications Hq., Cheltenham (England).
THE CONTROL OF F-LAYERS LUFs BY THE DEFOCUSING EFFECT OF THE LOWER LAYER
R. G. Maliphant *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 83–112 refs (See N70-16426 05-07)
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The Lowest Usable Frequency (LUF) for F-layer modes of propagation is frequently determined by the ionization present in a lower layer. This was thought to be a consequence of the lower layer obscuring part of the upper layer and the mechanism was referred to as cut-off by a lower layer, for example E layer cut-off. This concept is shown to be false and the mechanism controlling the LUF is shown to be the defocusing effect of the lower layer. Since this does not produce an absolute cut-off of the low-angle mode, the LUF may be reduced by an increase in transmitted power or improvement in the directive gain of the receiving antenna. The significance of this effect is described using data from a computer ray-tracing program which employs line segments of a particular form, fitted to the true electron density distribution, to obtain analytic solutions for the distance of propagation and unabsorbed signal strength. A better understanding of this mechanism should lead to more accurate predictions of the Lowest Usable Frequency. Author

N70-16438 Government Communications Hq., Cheltenham (England).
MAGNETO-IONIC EFFECTS IN POLARIZATION AND ABSORPTION
A. D. Morgan *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 113–125 refs (See N70-16426 05-07)
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The polarization and absorption of radio waves in the ionosphere, using the Appleton–Hartree equations is discussed. The analysis shows that, for frequencies near the lower limit of the HF Band, the use of correctly polarized aerials can give a substantial increase in the signal level. The absorption analysis is extended to the calculation of the LUF and, by extrapolating an electron density profile to years of different solar activity, the LUF is calculated as a function of sunspot number. The noise propagated by the ionosphere is also considered and is taken into account in estimating the LUF. Author

N70-16439 Marconi Co., Ltd., Great Baddow (England).
FIELD STRENGTH PREDICTIONS FOR BACK-SCATTER IONOSPHERIC SOUNDING
L. W. Barclay *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 127–136 refs Sponsored by Min. of Aviation, Engl. (See N70-16426 05-07)
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A theoretical assessment is made, using conventional prediction techniques, of the expected returns from a backscatter sounder in England operating across an overland path. Three particular hours in the two solstice months at sunspot minimum are examined and the ionospheric propagation modes and losses for two frequencies are predicted. A backscatter coefficient is assumed, based on very little experimental evidence, and the received backscatter field strengths are computed. It is shown that the returns, particularly in daytime, are restricted to relatively narrow range bands. Author

N70-16440 Stanford Univ., Calif.
A REVIEW OF OBLIQUE RAY TRACING AND ITS APPLICATION TO THE CALCULATION OF SIGNAL STRENGTH
Thomas A Croft *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 137–171 refs (See N70-16426 05-07)
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Recent developments in tracing radio rays with frequencies in the neighborhood of 2 to 10 MHz, with emphasis on their use for signal strength calculation. Many examples are included to show computed rays and their application to the solution of practical research problems. The digital computer has become the most popular means for raytracing in recent years; in the author's view, this trend will continue and strengthen, and so the review concentrates on digital techniques. It is concluded that rays can be computed with greater precision than is usually justified by the ionospheric data which must be used to specify the refractive index; thus there are no barriers to better ray tracing, but the limit of its utility will probably be set by the lack of good ionospheric data. Consideration is given to the alternate methods of raytracing, and the criteria for choosing among them. Since signal strength results are strongly influenced by ray accuracy, some methods for checking the computed results are given together with a model ionosphere for which exact answers are available. Author

N70-16441 Environmental Science Services Administration, Boulder, Colo.
THE ITSA THREE-DIMENSIONAL RAY TRACING PROGRAM
Kenneth Davies and R. Michael Jones *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 173–198 refs (See N70-16426 05-07)
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A three-dimensional ray-tracing program for the determination of radio ray paths in the ionosphere is described. The computer program is restricted to conditions under which ray theory is valid but includes effects due to the earth's magnetic field and of electron collisions. The potential usefulness of the program is illustrated by examples. Author

N70-16442 Environmental Science Services Administration, Boulder, Colo.
THE APPLICATION OF RAY TRACING TECHNIQUES TO RESEARCH AT MEDIUM FREQUENCIES
James W. Finney *In* AGARD Oblique Ionospheric Radiowave

Propagation Jun. 1969 p 199-208 refs (See N70-16426 05-07)

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Ray tracing techniques have been applied to a pilot study of nighttime sky wave medium frequency propagation. A ray tracing program has been modified to calculate absorption and polarization coupling losses. Calculations indicate that absorption is a power function of frequency, and the frequency exponent of about -1.8 is essentially independent of path length. The results further indicate that the combined polarization coupling loss plus absorption increases with path length. These results are not in complete agreement with those which would be inferred from studies based on a statistical analysis of empirical data. Author

N70-16443 Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany).

CALCULATION OF THE FIELD STRENGTH OF A RADIO TRANSMISSION FOR GIVEN ELECTRON DENSITY AND COLLISION FREQUENCY PROFILES

H. Kopka and H. G. Moeller *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 209-218 refs (See N70-16426 05-07)

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In an existing raytracing program the effect of absorption was included in order to calculate the field strength of different transmission modes. For distances of about 2000 km an investigation of whether the field strength on the F2 low angle mode can exceed the field strength on the F1 low angle mode has been carried out. For long distances an example will be given of the influence of variations in the electron density profiles along the path. Normally it is assumed that the angle of departure and the angle of arrival are equal. In this case the angles could be determined by the delay time observed with pulse transmissions. This method is useful especially for weak signals near the LOF. For long distances the variation of the electron density profiles acts in such a sense that these angles can differ as much as 100% at higher frequencies. Author

N70-16444 Norwegian Defence Research Establishment, Kjeller.

SOME RESULTS FROM RAY TRACING APPLIED TO HF IONOSPHERIC COMMUNICATION

K. Folkestad *In* AGARD Oblique Ionospheric Radiowave Propagation Jun.1969 p 219-223 ref (See N70-16426 05-07)

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Ray-tracing in ionospheric HF communications is discussed. A method for computing ray-paths and ionospheric absorption is described and some sample results are presented. The applicability of the method is discussed in the final section. Author

N70-16445* Sylvania Electronic Systems-West, Mountain View, Calif.

A MATHEMATICAL MODEL OF VERTICAL ANTENNAS OF FINITE LENGTH OVER AN INHOMOGENEOUS EARTH

Virgil R. Arens *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 225-248 refs (See N70-16426 05-07)

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A new approach to the solution of a problem common to two areas of oblique ionospheric radio wave propagation is presented. The application of ray tracing to calculate signal strength, and the determination of the lowest usable frequency from theoretical calculations is given. In both areas, the path antenna gain is an important parameter that must be known before solutions can be obtained. Mathematical models are derived for vertical antennas of finite length and height over a homogeneous earth on which a ground screen of finite length is placed. Results of automatic computer-calculated patterns are presented. The patterns, which are based on ray theory, are expressed in gain relative to a lossless isotropic antenna. The vertical antenna patterns can be controlled in part by varying the height and length of the antenna. By varying ground screen parameters, the surface impedance and hence the Fresnel reflection coefficient of the ground screen is varied, which in turn controls the vertical antenna pattern. The surface impedance is dependent primarily on the spacing of the wires and their radius. Author

N70-16446* Illinois Univ., Urbana. Dept. of Electrical Engineering.

POLARIZATION AND FADING NEAR THE LUF

Edgar C. Hayden *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 249-276 refs (See N70-16426 05-07)

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Problems of signal polarization and fading may be particularly acute immediately above the LUF. Swept-frequency ionograms illustrate the complex mode structure observed in this region of the spectrum. Spatial variations of wave amplitude are described in terms of angular spectrum concepts. This leads to a useful basis for signal classification. Poincare's method for representing states of wave polarization on a spherical map is outlined. The map has properties which make it extremely useful for visualizing, or calculating, the effects of wave polarization on antenna response. Live signal displays illustrate ionospheric wave polarization phenomena. The causes of fading are enumerated. Distribution function techniques are described for numerical specification of fading parameters. Definitions for fading range and realized directive gain are presented with quantitative illustrations. Signal classification helps to shed new illumination on the behavior of space diversity systems, and on the relationship of polarization diversity to space diversity. Author

N70-16447* Environmental Sciences Services Administration, Boulder Colo.

USE OF THE DOPPLER TECHNIQUE TO STUDY THE FADING OF HIGH-FREQUENCY IONOSPHERIC RADIO SIGNALS

Donald M. Baker and Kenneth Davies *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 277-284 refs (See N70-16426 05-07)

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A technique is described, briefly, for the determination of the frequency components in a fading radio signal reflected from the ionosphere. Examples of frequency records taken on quiet and disturbed days are presented for middle latitudes. Some unique records are shown of the frequency spreading observed during flutter-fading conditions in low geomagnetic latitudes. This frequency spreading appears to be closely related to spread-F echoes observed on oblique ionograms. Author

N70-16448* Defence Research Telecommunications Establishment, Ottawa (Ontario).

THE REFLECTION COEFFICIENT OF AN IONOSPHERE CONTAINING LARGE SCALE IRREGULARITIES

J. D. Caldwell, E. E. Stevens, and E. S. Warren *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 285-302 refs (See N70-16426 05-07)

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The reflection coefficient for a pulse of radio waves reflected from an ionosphere containing large scale fluctuations in the electron number density is calculated as a function of the angle of incidence and of the pulse duration. Comparison of the calculations with empirical data yields a statistical shape for irregularities of the reflecting surface. Author

N70-16449* Defence Research Telecommunications Establishment, Ottawa (Ontario).

SHORT-TERM AND AVERAGED CHARACTERISTICS OF NONRECIPROCAL HF IONOSPHERIC PATHS

G. W. Jull *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 303-322 refs (See N70-16426 05-07)

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The ability of ray theory to explain nonreciprocity on HR ionospheric paths is investigated. Some of the predictions of the ray theory of reciprocity as applied to single and multi-hop propagation paths are reviewed. Ray theory predicts non-reciprocity in phase for single magnetoinic waves transmitted between horizontally polarized antennas. If the antennas are elliptically polarized, there can also be nonreciprocity in amplitudes. The correlation between two-way, short-term fading of pulsed signals was positive and high when only one magnetoionic wave was present in the signal, but negative or low when both ordinary and extraordinary waves were present. The six-minute averaged path loss in opposite directions was equal within experimental errors for signals that underwent polarization fading. Shortterm discrepancies were found, and these can be attributed to insufficient averaging of polarization fading effects. Systematic differences in the path loss in opposite directions observed by others could be explained if the antennas were elliptically polarized for transmission paths that deviated from the great-circle path. Author

N70-16450* Radio and Space Research Station, Slough (England).

THE RADIO NOISE ENVIRONMENT AT HIGH FREQUENCIES

F. Horner *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 323-333 refs (See N70-16426 05-07)

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Attention is drawn to some of the limitations of existing noise data. Atmospheric noise data are subject to error when there are local storms; the noise power may then be underestimated. Measurements of man-made noise have been made mainly close to electrical apparatus and with specialized recorders, the estimation of the integrated noise on relatively good sites involves many assumptions which need to be substantiated. A better appreciation of the practical importance ofobtaining more accurate noise data for high frequencies is required before additional measuring programs can be justified. Author

N70-16451* Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany).

COMPARISON OF PREDICTED AND OBSERVED LUF

Hans G. Moeller *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 335-356 refs (See N70-16426 05-07)

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For short wave radio communication the lower limit of the usable frequency band, the so called LUF, is defined by the minimum signal to noise ratio which is necessary for good reliability in a communication link. In predicting this ratio the calculation of the field-strength is the main problem. To calculate the field-strength, which a transmitter of known characteristics produces at a receiver site at a distance D, it is first assumed that no absorption exists. If the electron density profiles along the route are given by vertical sounding data it is a problem of geometrical optics to determine the different possible paths between the transmitter and receiver and to calculate the spatial attenuation. Normally for a fixed frequency more than one path between transmitter and receiver is possible. As the possible paths or modes are known the absorption for each mode can be calculated by integrating the losses along the path. This would be the ideal case. In reality neither the electron density profiles nor the absorption along the route are known with sufficient accuracy. Normally only mean predicted profiles are available and this fact justifies the tendency to simplify the prediction methods. Author

N70-16452* Weapons Research Establishment, Salisbury (Australia).

LOF OBSERVATIONS ON TWO TRANSEQUATORIAL CIRCUITS DURING SUNSPOT MINIMUM

G. G. Mc Cue *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 357-370 refs (See N70-16426 05-07)

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LOF observations were made on two long-distance step-frequency radio circuits in the Pacific Area during a sunspot minimum period, 1964-65. These measurements are reported and compared with predictions of the absorption limiting frequency for the two circuits. Attempts to correlate LOF characteristics with changes in geomagnetic planetary index, Zurich relative sunspot number and solar flux on 2800 Mc/s revealed no such associations. Difficulties in making LOF measurements and some unexplained features of LOF variations are brought to notice. Author

N70-16453* Research Inst. of National Defence, Stockholm (Sweden).

SOME RECENT OBLIQUE MEASUREMENTS IN THE HF-BAND ON THE PATH KIRUNA-STOCKHOLM

R. Lindquist *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 371-384 refs (See N70-16426 05-07)

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Recordings were made on the path Kiruna-Stockholm (960 kilometres) during the period 1959-1966 using two fixed-frequency pulsed transmitters, viz 3.0 and 6.7 MHz. These measurements were complemented, since March 1966, with half-hourly recordings of oblique soundings, mainly in the frequency band 3.6-14.0 MHz. The values of the MUF and LUF as deduced from the different recordings are discussed. These results will be compared to ionosonde measurements at the midpath and also to the monthly median predictions. Conditions typical of auroral paths will also be discussed. Author

N70-16454* Defence Research Telecommunications Establishment, Ottawa (Ontario).

THE VERTICAL AND OBLIQUE INCIDENCE REFLECTION COEFFICIENTS OF THE IONOSPHERE

L. E. Petrie, E. L. Hagg, and A. G. Stapley *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 385-391 refs (See N70-16426 05-07)

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The apparent reflection coefficients of the ionosphere were

studied using vertical and oblique incidence pulse amplitude data. Pulse transmissions radiated from Ottawa at a frequency of 2.75 Mc/s were recorded at vertical incidence and at a distance of 160 km from Ottawa. During the night the F-layer first-hop apparent reflection coefficient due to focusing remained approximately unity at oblique incidence for all Spread F conditions while at vertical incidence it increased in magnitude by a factor of about 2.5 with increasing Spread F. Author

N70-16455* Radio and Space Research Station, Slough (England).
FIELD STRENGTH DETERMINATION AT HIGH FREQUENCIES
P. A. Bradley *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 393–411 refs (See N70-16426 05-07)
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The methods of prediction of field strength of Piggott and Haydon are applied to an experimental circuit. Calculations are made for a vertical aerial, a horizontal broadside aerial and a horizontal end-on aerial at the receiver. The simplifications inherent in the methods are examined for this circuit and it is found that important polarization corrections are necessary for the signals on the horizontal broadside aerial. The two methods predict different dominant modes for a considerable proportion of the time that the circuit is open, but the average predicted received signal amplitudes are comparable. Serious discrepancies are found however in the summer daytime, particularly on the lower frequencies. The experimental data suggest that the method of Piggott is more nearly correct for these cases. The extraordinary wave is frequently stronger than the ordinary wave when receiving signals on the horizontal broadside aerial. Author

N70-16456* Forschungsinstitut fuer Hochfrequenzphysik, Bonn (West Germany).
CORRELATION OF PREDICTED AND OBSERVED VALUES OF LUF ON A QUASI-ANTIPODAL CIRCUIT
H. J. Albrecht *In* Agard Oblique Ionospheric Radiowave Propagation Jun. 1969 p 413–416 refs (See N70-16426 05-07)
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Reference is made to data collected in Australia on long distance HF circuits from 1952 to 1957. A relevant portion has recently been re-examined with respect to correlation values for some of the possible LUF prediction procedures. It is intended to report upon results briefly. Of particular interest appears to be the material available for the quasi-antipodal circuit Melbourne-London. The importance of utilizing quiet-sun conditions for HF propagation analysis was emphasized some time ago, records of the period 1953-54 were selected as most representative. With regard to the more practical approach of investigating the effect of LUF predictions upon telecommunications, the times at which the LUF permitted certain frequencies to be used for long-distance traffic were thought to be of more value than a simple indication of the actual LUF. In general, typical signal sources received at Melbourne were standard transmissions from WWV, MSF, etc. However, this more detailed investigation was conducted on one frequency within the typical LUF-range, around 3.5 MHz, and one in the higher part of this range, around 7 MHz. A comprehensive description of investigations, equipment, and results was published approximately a decade ago. Author

N70-16457* General Electric Co., New York.
EFFECTS OF THE LOWER IONOSPHERE ON HF PROPAGATION MODES OVER A 3700-KM PATH
C. Roberts, L. Humphrey, and R. Mather *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 417–430 refs Prepared in cooperation with RADC (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

The interim results of a propagation loss experiment on a path between the Panama Canal Zone and uptstate New York are presented. This experiment employs a high-resolution pulse system that permits observation of the individual ionospherically propagated modes. Two-way oblique soundings are also made for mode structure analysis and propagation times measurements. The loss in the D-region can be determined on the two-hop E path, which on the average compared well with standard predictions. The two-hop F2 path at times shows unusually high losses, which have been attributed to partial reflections in a high sporadic E-layer observed over parts of the path. Polarization rotation measurements were also made, with use of a vertically polarized antennat at Panama, and vertically and horizontally polarized antennas in New York. The random amplitude fading was removed by division, yielding the polarization fading effects. Interim measurements reveal polarization fades of E-layer-reflected signals to be a function of the LUF; and of F2-layer-reflected signals to be a function of the ratio of operating frequency to MUF. Measurements also revealed horizon, skip distance, and geometric focusing. Author

N70-16458 Leicester Univ. (England). Dept. of Physics.
TIME VARIATIONS OF THE EFFECTIVE LUFs FOR 730 AND 860 km PATHS
T. B. Jones and W. Keenliside *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 431–438 refs Sponsored in part by Min. of Aviation, Engl. (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

A study was made of the diurnal and seasonal variations of the fade-out and fade-in times of the 1.95 Mc/s pulse transmissions from the Hebrides station of the Loran navigation system and the 5 Mc/s carrier wave of HBN Geneva. The HBN no signal times and the absorption measured on the equivalent vertical frequency for the path are found to be correlated. The effects of sunspot number and seasonal changes are evident on the oblique paths and are similar to those reported for vertical incidence propagation. Author

N70-16459 Granger Associates, Palo Alto, Calif.
MEASUREMENT AND SHORT TERM PREDICTION OF THE LOWEST USABLE FREQUENCY
R. D. Egan *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 439–450 refs (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

Synchronized oblique sounding provides accurate and detailed information on the time dispersion and amplitude of signals propagated by ionospheric reflection between two stations. Assuming comparable equipment sensitivities, it is shown that the lowest observed frequency on the oblique ionogram can be closely related to the predicted LUF on a temperate latitude 3800 km path. Statistical analysis of oblique data obtained on this same path has shown that the LOF is amenable to short term prediction based solely on oblique sounding data. The observed reduction of variance rises from 0.59 at a prediction lead of 10 min. to 0.83 at 60 min. and is within 3% of the limiting values determined by the autocorrelation of the data. The technique has been simulated on a large computer and subsequently implemented on a small computer operating online in real time with an oblique sounder. Author

N70-16460 Stanford Research Inst., Menlo Park, Calif.
SOME RESULTS OF AN OBLIQUE-INCIDENCE PULSE-SOUNDING HF (4-TO-64-MHz) EXPERIMENT BETWEEN ANDOYA, NORWAY, AND COLLEGE, ALASKA
Richard R. Bartholomew *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 451-466 refs (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

An oblique-incidence pulse-sounding experiment was conducted during 1964 between Andoya, Norway and College, Alaska. Approximately one year of data was collected during the experiment, by using Granger Associates step-frequency sounders with a frequency range of 4 to 64 MHz. Propagation outage is shown to have averaged 25% on quiet days and 35 to 40% on disturbed days. Seasonal plots of the propagating frequency spectrum as a function of time of day are presented, and seasonal effects are shown to have been more pronounced than diurnal effects. Modes of propagation are discussed, and it is shown that mixed modes commonly determined the MOF (maximum observed frequency). Off-path, or non-great-circle, modes are examined, and it is concluded that these modes are a result of auroral scattering. A comparison of MUF and LUF predictions shows that the predicted propagation spectrum was very much narrower than the observed spectrum. Author

N70-16461* Stanford Research Inst., Menlo Park, Calif.
A PROPOSED TERMINOLOGY FOR IONOSPHERICALLY PROPAGATED BACKSCATTER MODES
Richard R. Bartholomew *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 467-470 refs (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

A standard terminology is needed for describing the mode geometry of back-scattered and forward-scattered radio energy. The following suggestions are made: the region of the ionosphere from which radio-frequency energy is returned to the transmitter should be indicated by placing a slash (/) after the letter designating it. If the energy is returned from ground, a hyphen should precede the slash (e.g., F/,F-/,Es/). The reflections, or hops, should be specified in their chronological order with respect to the transmitter. If a returned ray does not retrace the forward path, the return path should be indicated following the slash. The proposed terminology has the following advantages: Only one symbol, the slash, available on all typewriters, would be added to current terminology. It is unambiguous. Backscatter modes, oblique-incidence forward modes, and indirect (or non-great-circle) modes can be uniformly described. Author

N70-16462 Sheffield Univ. (England). Dept. of Physics.
IONOSPHERIC OBLIQUE BACKSCATTER OBSERVATIONS AT 17 Mc/s DURING THE IQSY
W. J. Baggaley *In* AGARD Oblique Ionospheric Radiowave Propagation Jun 1969 p 471-486 refs Sponsored by Sci. Res. Council (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

The examination of the various factors governing the propagation of high frequency radio waves in backscatter sounding is required. Backscatter observations carried out during the I.Q.S.Y. are described and some preliminary results presented. Author

N70-16463 Stanford Univ., Calif.
OBLIQUE CHIRP SOUNDING
G. H. Barry and R. B. Fenwick *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 487-501 refs (See N70-16426 05-07)
(Contract Nonr-225(64))
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

The quality of oblique ionospheric pulse sounding records can be improved through the use of more complex sounding singals. The use of a linear FM transmission allows a unity transmitter duty cycle and permits the convenient rejection of narrow-band interference resulting from other HF spectrum users. Oblique ionograms are presented demonstrating the capabilities of Chirp sounding and comparing it with simultaneous pulse soundings. The technique has been used on frequencies from 600 kHz to 32 MHz, and on various paths ranging in length from 2000 to 40 000 km. The attainment of 20 micron sec time-delay resolution on long paths, using transmitted power of the order of 100 watts and without record degradation from other HF users, implies that the Chirp sounding technique may supplant pulse sounding in applications where higher time-delay resolution, lower peak transmitter power, or improved interference rejection are necessary. Author

N70-16464 Stanford Research Inst., Menlo Park, Calif.
AUTOMATIC ANALYSIS OF OBLIQUE-INCIDENCE SOUNDER DATA
John B. Lomax *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 503-524 (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

Equipment was developed to convert the analog signal output from an oblique-incidence ionospheric sounder to a digital representation of that signal and to record the digital data on magnetic tape in a computer-compatible format. Computer programs were developed to analyze the data automatically and to cause an automatic plotter to present the resulting data on an inked drawing in a final form suitable for use in a report. The results are obtained rapidly and accurately without human intervention. The analysis of the data is essentially a problem in pattern recognition. To complicate the matter further, the pattern is immersed in noise and interference. The analysis routines are therefore first concerned with extraction of the signal from the background of noise and interference. Time-domain filtering is employed to obtain near-optimum detection. Following the separation of signal from noise, the range of propagating frequencies and the multipath and signal amplitudes as functions of frequency are determined. The dominant E mode is automatically identified, using its characteristic constant time delay versus frequency. Finally, the oblique data are transformed to equivalent vertical-incidence data, and the midpath critical frequency is determined. Author

N70-16661 Duke Univ., Durham, N.C.
SEQUENTIAL SIGNAL DETECTION: A DISCRETE FREQUENCY DOMAIN APPROACH
Norman Lee Owsley (Ph.D. Thesis) 1968 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-3849

There is considerable current interest in adaptive signal processing techniques which have the capability of sequentially extracting additive amounts of signal related information from a random background. In many types of signal processing techniques it is quite advantageous to analyze the available data with respect to its spectral information content. An optimal approach to the sequential processing of time limited discrete spectra is presented in this dissertation. There are two primary objectives in a consideration of the above mentioned sequential mode, discrete frequency domain signal processing strategy. First, it is desirable to develop a unified approach to the optimum (minimum risk) sequential detection of a parametrically defined signal in noise based

on a record of time limited sample spectra. Secondly, once having made an affirmative signal detection decision, it is required that the sequential processor classify the signal and give optimal estimates of its important spectral parameters. Dissert. Abstr.

N70-16763 California Univ., Berkeley.
COMPUTATION AND BOUNDING OF RATE-DISTORTION FUNCTIONS FOR CERTAIN MESSAGE SOURCES AND DISTORTION CRITERIA
Barin Geoffrey Haskell (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-3608

Shannon's rate-distortion function R(D) specifies the minimum channel capacity necessary to transmit the output of a given message source with an average distortion D. A message source which emits a sequence of independent, discrete valued random variables is discussed first. The computation of R(D) for this case is reduced from a constrained minimization problem involving transition probabilities to a simpler minimization problem involving only destination symbol probabilities. For an arbitrary ergodic message source which emits a sequence of finite duration messages, upper and lower bounds on F(D) are obtained by partitioning the set of messages and the set of destination symbols each into a countable collection of subsets, and then using the results previously obtained for discrete random variable message sources. Conditions are discussed under which these bounds can be made arbitrarily close to each other. Dissert. Abstr.

N70-16769 Ohio State Univ., Columbus.
A SEQUENTIAL, SELF-SYNCHRONOUS, BEAM TAGGING TECHNICUE FOR ADAPTIVE CONTROL OF TRANSMITTING ARRAYS
James Eugene Tourdot (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-4988

The beam tagging operation, phase error measurements, and phase corrections are performed sequentially in time for each signal transmitted from the array. This approach eliminates the need for more than one beam tagging modulation. The system is self-synchronous since the phase error detection receiver processes the down-link signal to obtain phase control information in the presence of the data modulation. An analysis is performed which relates the phase error measurement accuracy to the system parameters, namely: (1) the data transmission rate, (2) the number of array elements, (3) the signal-to-noise ratio and (4) the time devoted to estimating the phase error. A particular closed-loop model for the phase control operation is developed and shown to be equivalent to a sample data feedback control system. This closed-loop model is analyzed to determine the required phase measurement accuracy and the phase correction rate for successful adaptive transmitting array operation. Two design examples are presented to illustrate the use of results derived. Dissert. Abstr.

N70-16772 Colorado Univ., Denver.
A QUASI-OPTICAL METHOD FOR CALCULATING PROPAGATION OF LF RADIO WAVES IN THE PRESENCE OF AN IONOSPHERE WITH HORIZONTAL GRADIENTS. PART 1: RAY THEORY FOR LOSSY MEDIA. PART 2: DIFFRACTION BY THE EARTH
Richard Michael Jones (Ph.D. Thesis) 1968 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-4354

To predict communication conditions between a given transmitter and receiver, or to use radio waves to measure ionospheric characteristics, it is desirable to calculate the effect of the earth and ionosphere on radio waves. This thesis presents an extension of ray theory which satisfactorily calculates reflection of LF (30 to 300 kHz) radio waves from the ionosphere. This extension uses the complex refractive index in Snell's law to calculate the ray path. In effect this includes ionospheric losses in determining the ray path, which are very improtant in the D region, where LF waves are reflected. Although the resulting ray paths, being in complex space, have less physical interpretation, they give accurate results. An accompanying approximation which compensates for the ray's missing the receiver is essential for ray tracing in complex space, but would also be very useful in ordinary ray tracing. Dissert. Abstr.

N70-16845# Boeing Co., Renton, Wash. Commercial Airplane Div.
PROPOSED BINARY INTERSYSTEM TRANSMISSION CHARACTERISTIC REFERENCE DATA AND RATIONALE
John E. Scheurell 7 Oct. 1969 65 p
(AD-695352; D6-23849-1) CSCL 17/2

The objective of this study was to review the various technical considerations applicable to the selection of a single Binary Intersystem Transmission Standard (BITS) adaptable to future commercial airplanes. Study results to date indicate that the advantages of split-phase-bipolar modulation are sufficient to recommend it over other techniques considered. The suggested message format includes one bit of double amplitude to define the word beginning, 12 bits for address, and 24 bits for data. In addition, tutorial discussions are presented on: (1) Analog data sampling rate errors and effects, (2) Some of the effects of interconnecting many data transmitters and receivers using a common digital data transmission system, (3) The effect of bits per word, word transmission (sampling) rate, and number of signals on the transmission clock rate. The study has established the relative advantages/disadvantages of various BITS concepts from the technical viewpoint. It has also established that operational requirements will be of sufficient importance to influence the basic BITS system concept to the point that multiple transmission concepts may be advantageous over any single concept. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-15565*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL ANALYSIS OF DATA FROM THE "SIRIO" FLUXGATE MAGNETOMETER
Norman F. Ness Nov. 1969 27 p refs
(NASA-TM-X-63789; X-616-69-523) Avail: CFSTI CSCL 09B

The magnetic field experiment on the SIRIO spacecraft uses a triaxial set of sensors to obtain precise measurements of the vector magnetic field. An early assignment of telemetry allocated a total of 96 words of 8 bits each. The sampling rate of the instrument was 4 times per frame, uniformly spaced, so that the Nyquist frequency was 2 times the frame rate, which is twice the nominal spin frequency of the satellite but only slightly higher than the proton cyclotron frequency. The problem of doubling the sampling rate in the first six frames, but not in frame 7, is investigated with respect to the effects in spectral analysis using data which periodically contain missing values. General principles are also outlined for analyzing the effects on spectral analysis of uniformly sampled data streams which contain missing values. Author

N70-15572# Illinois Univ., Urbana. Coordinated Science Lab.
ON BOUNDS AND IMPLEMENTATION OF ARITHMETIC CODES

Se June Hong Oct. 1969 14 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-2339)
(AD-695763; R-437) Avail: CFSTI CSCL 9/4

The upper bound on the rate of the arithmetic code is derived. Comparisons to actual rates are presented. Some codes have rates very close to this bound. A simple decoding method is presented for a general multiple error correction. The time required for the decoding depends on the decoding index k. For a small decoding index, the decoding can be much faster by using some parallel hardwares. Author (TAB)

N70-15577# Stanford Univ., Calif. Artificial Intelligence Project.
THE CORRECTNESS OF NON-DETERMINISTIC PROGRAMS
Zohar Manna Aug. 1969 46 p refs
(ARPA Order SD-457)
(AD-694971; SU-Memo-AI-95) Avail: CFSTI CSCL 9/2

The paper formalizes properties of non-deterministic programs by means of the satisfiability and validity of formulas in first-order logic. The main purpose is to emphasize the wide variety of possible applications of the results. Author (TAB)

N70-15592# Naval Research Lab., Washington, D.C. Mathematics and Information Sciences Div.
UNIVERSAL LOGIC BLOCKS Interim Report
Barry P. Shay 17 Sep. 1969 21 p refs
(AD-696056; NRL-6927) Avail: CFSTI CSCL 9/5

Combinatorial networks are usually synthesized from integrated-circuit building blocks. Advances in integrated-circuit processing technology permit the placement of more logic on a single block, but raise two new questions as to what logical functions should be placed on a block and how combinatorial networks can be efficiently synthesized from a family of blocks. The Universal Logic Block (ULB) provides a promising approach towards answering these questions. A ULB produces a particular function of n Boolean variables (and its complement) that has the property of covering any Boolean function of k or fewer variables by suitable input partitioning. Such functions are known as Globally Universal (GU) functions. Currently available methods of finding GU functions depend upon realizing certain equivalence classes of Boolean functions. The enormous growth rate of these classes limits the practicality of such methods. Techniques must be found which either avoid the realization of equivalence classes, or enlarge each class by defining new relations on the set of Boolean functions. The synthesis of large networks using the GU block as the logical connective remains a difficult problem. By placing constraints on the desired network, realistic design criteria can be established. Considerations to be taken into account include size of the block to be used, delays associated with the block, and the mixing of various types of blocks. Author (TAB)

N70-15656# Illinois Univ., Urbana. Coordinated Science Lab.
ERROR CORRECTION IN HIGH SPEED ARITHMETIC
Robert T. Chien and Se June Hong Oct. 1969 27 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-2339)
(AD-695764; R-438) Avail: CFSTI CSCL 9/4

The errors due to a faulty high speed multiplier are shown to be iterative in nature. These errors are analyzed in various aspects. The arithmetic coding technique is suggested for the improvement of high speed multiplier reliability. Through a number theoretic investigation, a large class of arithmetic codes for single iterative error correction are developed. The codes are shown to have near-optimal rates and to render a simple decoding method. The implementation of these codes seems highly practical. Author (TAB)

N70-15668# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
COMPUTER ANALYSIS AND CLASSIFICATION OF WAVEFORMS AND PICTURES. PART 1: WAVEFORMS
Edward A. Patrick, Frederick P. Fischer, II, and Leon Y. Shen Griffiss AFB, N.Y. RADC Sep. 1969 124 p refs
(Contract F30602-68-C-0186)
(AD-695835; RADC-TR-69-279) Avail: CFSTI CSCL 9/2

Fundamental operations used in processing waveforms and pictures are collected together under the framework of the Bayes approach. Algorithms corresponding to the operations are stored in a computer. An operator experimentally determines a sequence of operations which maximizes a performance criterion related to the accuracy with which the waveforms or pictures can be correctly classified. Two classes of operations are considered. One class contains operations which are interpretive allowing the operator to perform data (waveforms or pictures) analysis. These interpretive operations provide an interactive capability between the operator and the computer. The second class of operations is for actual data processing with the end result of discrimination (includes detection and classification). The operations in this second class are based on the philosophy that a priori knowledge is available and is to be utilized. Within this second class of operations are three subclasses of operations. (a) Feature extraction--utilization of a priori knowledge through a model specific to the problem; (b) Dimensionality reduction using estimation; (c) Discrimination (supervised and unsupervised) using estimation. Author (TAB)

N70-15682# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
INFORMATION RATES OF AUTOREGRESSIVE SOURCES Interim Technical Report
Robert M. Gray Aug. 1969 134 p refs
(Grant DA-ARO(D)-31-124-G929)
(AD-695717; USCEE-369; AROD-7198-12-RT) Avail: CFSTI CSCL 9/4

The rate distortion function, R(D), of a source can be interpreted as being the average amount of information that must be transmitted about a source for the receiver to be able to approximate the source within an average distortion D. It is demonstrated that for the class of time discrete autoregressive sources the rate distortion function for any difference distortion measure is lower bounded by the rate distortion function of the independent letter source that generates the autoregressive source. Autoregressive sources are constructed by passing such an independent letter source through a time discrete linear filter whose z-transform has only poles. This behavior holds even if the autoregressive source is non-stationary. The lower bound is shown to hold with equality for a non-zero range of small average distortion for two important special cases: the class of possibly nonstationary Gaussian autoregressive processes with a mean square error fidelity criterion and the binary symmetric first order Markov source with an average error per bit fidelity criterion. The positive coding theorem is proven for the possibly nonstationary Gaussian autoregressive process with a constraint on its parameters. Author (TAB)

N70-15696# Keydata and Adams Associates Inc. Watertown, Mass.
INVESTIGATION OF METHODS FOR INTERFACING AND EFFICIENTLY OPERATING ITEMS OF M460 SYSTEM SOFTWARE Final Report, Oct. 1968 - Sep. 1969
Leonard M. Hantman and Robert M. Metcalfe 30 Sep. 1969 8 p
(Contract F19628-69-C-0080)
(AD-694497; AFCRL-69-0398) Avail: CFSTI CSCL 9/2

The report contains a summary of the work done in further developing well-organized and versatile software in support of an evolving, on-line operating system for the M-460 computer. The major effect involved the implementation of additional portions of the generalized I/O system and further testing and modification based on actual user experience with the system. Author (TAB)

N70-15707*# Texas Univ., Austin. Electronics Research Center.
COMMENTS ON LINEAR FEATURE EXTRACTION
T. L. Henderson and D. G. Lainiotis 15 Apr. 1969 12 p refs
(Grants NGR-44-012-066; AFOSR-766-67; AF-AFOSR-1764-69)
(NASA-CR-107698; AD-690136; TM-8; AFOSR-69-1022TR)
Avail: CFSTI CSCL 09D

The problem considered is that of finding the best linear transformation to reduce a random data vector z to vector of smaller dimension. It is assumed that the original data are Gaussian under either of two hypotheses. The Bhattacharya distance is used to measure the information carried by the transformed data. A compromise solution is obtained for the case in which the data has both different means and different covariances under the alternative hypotheses. Author (TAB)

N70-15711# Sperry Gyroscope Co., Ltd., Bracknell (England).
THE ARINC ATLAS TEST LANGUAGE
D. I. Saunders Apr. 1969 37 p refs
(TN-995) Avail: CFSTI CSCL 09/2

The increasing international use of automatic test systems by the commercial airlines in order to meet economic pressures, shows that a disciplined and standardized language is urgently needed for the statement of performance test requirements by the manufacturers of complex equipment and systems. The standard language must have a sufficiently high level to be usable by human operators, and the ATLAS language was developed under ARINC sponsorship to meet all needs. Problems of computer availability and cost may arise at the stage of compiling machine instructions from this high-level language. Events leading to the present international acceptance of ATLAS are surveyed in this note which considers the future development of the language and the likely benefits from widespread adoption of ATLAS by manufacturers of avionic and other equipment, and by the Services. Author

N70-15713# Dabcovich and Co., Inc., Lexington, Mass.
A TEXT EDITOR FOR THE UNIVAC M-460 COMPUTER DEC-340 OSCILLOSCOPE Final Report 26 Sep. 1968 - 25 Jul. 1969
Ross Vicksell Sep. 1969 21 p
(Contract F19628-69-C-0089)
(AD-695813; AFCRL-69-0387) Avail: CFSTI CSCL 9/2

The report recounts the evolution of an oscilloscope-based text editor. The more important subroutines in the system are discussed and compared with their counterparts in the original system. The text-buffer to scope-buffer translator is dealt with at some length. Finally, operating instructions for the new system are included. Author (TAB)

N70-15780# Air Force Cambridge Research Labs., Bedford, Mass.
CLASSIFICATION OF MIXED-FONT ALPHABETICS BY CHARACTERISTIC LOCI
Herbert A. Glucksman Aug. 1969 21 p refs
(AD-694487; AFCRL-69-0349) Avail: CFSTI CSCL 9/4

An alphabetic pattern is reduced to a vector of many dimensions (pattern features), each of which is the area of a locus (region) in the patterns background. Each locus is the set of the points of the background that share, in a certain sense, a particular view of the patterns line. A corrective learning process, executed by computer, linearly separates the vector space into alphabetic categories so that every pattern, of a large selection of patterns of nine different fonts, is found in its proper category, without regard for font and despite some noise. When the coefficients of the separating hyperplanes are then used to classify patterns not included in the learning sample, the error rate decreases sharply as the learning sample is increased. An implementation is described that would associate a digital computer with a special device that would include a matrix of simple, identical, intercommunicating microcells capable of determining the patterns features. A method is described for designing by computer a binary decision tree that, using the coefficients determined by the learning process, would speed up the classification of patterns. Author (TAB)

N70-15829# Hawaii Univ., Honolulu. Information Sciences Program.
ON MARKOVIAN LATTICES
Thomas N. Gaarder 28 Jul. 1969 49 p refs
(Grant AF-AFOSR-1251-67)
(AD-694132; AFOSR-69-2265TR) Avail: CFSTI CSCL 9/4

In many information processing problems one is confronted with modeling a random quantity that depends upon two, or more, parameters. A natural model for such a quantity is a random function of multi-dimensional argument; i.e., a random field. In this paper we consider random fields that are defined on only a discrete set of points; the points from a rectangular lattice in an n-dimensional space. The Markovian property of processes is extended to include such random fields. The extension is non-trivial since the concept of a preferential direction is lost in the transition to a multi-dimensional argument. In addition, Levys definition of a Markov random field on all of n-space is not easily extended to a field defined on a lattice. Particular emphasis is given to homogeneous random lattices; a homogenous lattice is one with probabilities that are invariant to all coordinate translations. Discrete, homogeneous, Markov lattices are practically determined by n commutative transition matrices -- one for each principle coordinate of the space -- and an initial condition. Another useful property of random fields is isotropy, or invariance to all coordinate rotations, as well as to all coordinate translations. It is shown that there are no isotropic, Markov lattices other than the trivial white one. Author (TAB)

N70-15853# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
ANALYZING JOB MIX IN MULTIPROGRAMMED COMPUTER SYSTEMS Research Report
Paul R. Kleindorfer and Charles H. Kriebel Aug. 1969 30 p refs
(Contract NONR-760(24))
(AD-695766; RR-166) Avail: CFSTI CSCL 9/2

The study presents a formal model of multiprogrammed systems based on an empirical analysis of operations at a commercial teleprocessing installation. In particular, the study analyzes the interactive effects on system thruput of job mix, local (operator) scheduling, and monitor design in a multiprogrammed environment. The analysis shows that job mix effects considerably influence system performance and decreasing them will result in increased thruput. Author (TAB)

N70-16019# Netherlands Research Centre TNO for Shipbuilding and Navigation, Delft. Shipbuilding Dept.
THE COMPUTER PROGRAMMES SYSTEM AND THE NALS LANGUAGE FOR NUMERICAL CONTROL FOR SHIPBUILDING
H. Le Grand Aug. 1969 16 p refs *Its* Communication No. 195
(S/5-102) Avail: CFSTI

The more extensive possibilities are described to make computer calculations for shipbuilding since the installation of the new CDC-3300 computer at the Netherlands Ship Model Basin; special attention has been given on the field which earlier was covered by the Autocode language, which was in fact very restricted because of the limited possibilities of the computer. Essential is to furnish the yards a possibility to prepare input for numerical control as easy as possible. Therefore a more sophisticated language NALS (Numerical control Adapted Language for the Shipbuilding) has been developed. Advantages are explained and emphasis is put on the availability of a data bank, which is fully integrated in the large complex of programmes that has the name CALS (Computer Adapted Language for Shipcalculations). Author

N70-16177# Comitato Nazionale per l'Energia Nucleaire, Frascati (Italy).
PDR PROGRAMMER FOR DIGITAL RECORDER [PDR PROGRAMMATORE PER DIGITAL-RECORDER]
S. Lupini and C. Prezzi 5 May 1969 15 p ref In ITALIAN *Its* Nota Interna No. 444
(LNF-69/29) Avail: CFSTI

A digital recorder program is described that operates in conjunction with the measuring and conversion systems. It has an ascessioning capacity of 360 bit, divided into 90 words of four bit. The programmer is subdivided into these functional parts: (1) input circuit and programmer for channel selection, (2) gate circuits for selected channel, (3) code conversion circuits, and (4) operation programmer. Transl. by F.O.S.

N70-16210# HRB-Singer, Inc., State College, Pa.
MAINTAINING INTERPRETER PROFICIENCY IN A COMPUTERIZED FACILITY. EXPERIMENT 1: PROGRAMMING AND FEEDBACK METHOD
Robert T. Root, Paul D. Gallagher, and Robert Sadacca (Army Behavioral Sci. Res. Lab.) Apr. 1969 37 p refs
(Contract DA-49-092-ARO-142)
(AD-694349; TN-209) Avail: CFSTI

The document reports on a study of the usefulness and feasibility of computer-assisted instruction, utilizing the equipment to be found within an advanced computer-based image interpretation facility, for the maintenance and improvement of interpreter skills. Author (TAB)

N70-16249# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
AUTOMATA GAMES, STOCHASTIC AUTOMATA AND FORMAL LANGUAGES
T. J. Li and K. S. Fu Jan. 1969 139 p refs
(Grants AF-AFOSR-69-1776; NSF GK-1970)
(AD-694987; TR-EE-69-1) Avail: CFSTI CSCL 9/2

The report is mainly concerned with the behavior of a class of learning automata operating in random environment and a preliminary study of relating automata theory to formal languages. Based on the strategies of two-armed bandit problems, two sequential learning models having deterministic and stochastic transition rules, respectively, are proposed. Based on the iterated logarithm inequality, confident automation A is formulated which is able to find the optimal action in finite time. The learning composite fuzzy automaton operating in a random environment has shown the desired property of asymptotic optimality. Applications of the learning automata to pattern classification and feature selection have also been considered. Computer simulated examples for the applications of the proposed models include games against nature and two-person zero-sum games. A survey is given concerning the basic concepts and properties of phrase-structure languages. TAB

N70-16474 California Univ., Los Angeles.
TOOLS FOR THE CONSTRUCTION OF DESIGN AUTOMATION SYSTEMS
Richard Lee Mandell (Ph.D. Thesis) 1968 229 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 69-5335

Systems of programs which are used in automating the design of digital computers are extremely large and expensive to construct. The major tool to be used in constructing such a system of programs must be a general purpose compiler. The PL/I compiler supplies most of the facilities required for constructing design automation systems. However, PL/I does not provide adequate facilities for constructing language translators and for manipulating libraries with variable content, variable length records. This dissertation describes a set of languages which augment the PL/I language in these areas. Translators are used in design automation systems to process communications between the designer and the system, to convert files from one format to another and to perform actual design oprations. The translator writing language described in this dissertation is called META/360. Dissert. Abstr.

N70-16495# Hawaii Univ., Honolulu.
UNIVERSITY OF HAWAII TIME-SHARING SYSTEMS: ALOHA SYSTEM
Norman Abramson Oct. 1969 8 p In JAPANESE; ENGLISH summary Presented before Audio-Visual Inform. Res. Group of the Electrotech. Lab. of the Japan. Min. of Intern. Trade and Ind., Tokyo, 5 Jun. 1969
(Contract F44620-69-C-0030; Proj. THEMIS)
(AD-695050; AFOSR-69-2591TR) Avail: CFSTI CSCL 9/2

This report consists of a transcript of a talk delivered before the AVIRG (Audio-Visual Information Research Group) of the Electrotechnical Laboratory of the Japanese Ministry of International Trade and Industry in Tokyo, Japan, on June 5, 1969 by Dr. Norman Abramson, Project Manager of the ALOHA SYSTEM. The talk was subsequently reprinted in DATA Communication and Processing, Vol. 1, No. 8, published in Tokyo. This report is reprinted from that journal. Author (TAB)

N70-16517# Los Alamos Scientific Lab., N.Mex.
LAMPF CONTROL PHILOSOPHY
Raymond A. Gore *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 134-139 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

Basic control areas are defined; various operating systems (vacuum, water, magent, beam monitoring, and RF) and the basic approach to computer control of the accelerator are discussed. The EPA computer control results are presented. Heuristic approach was used for EPA accelerator control and for systems with large numbers of variables, but the possibility of better control by an analytical approach is considered. Flexibility in the system is for computer use as a data acquisition system and for operation of control and instrumentation channels. Potential applications of computer control are extended for local closed loop control areas where the dynamic response time of the system is in the computer sampling rate range. J.A.M.

N70-16518# Los Alamos Scientific Lab., N.Mex.
PROGRAMS FOR COMPUTER CONTROL OF EPA
M. D. J. Mac Roberts, Sally Ohlsen, C. M. Plopper, D. D. Simmonds, and R. F. Thomas *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 140-148 Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

Computers, peripherals, and channels of SEL-810A with internal registers and 16 bit memory words are reviewed, as well as special purpose displays and automatic accelerator procedures. System program structure is briefly described pertaining to program scheduling, input output handling, and priority interrupt response. The applications program performs three tasks: (1) to enable an operator to exercise control over the accelerator from the control room via the computer (2) to record data from the accelerator; and (3) to imitate the actions of operators in performing routine procedures such as turn-on sequences. Four console command programs service the control buttons and switches on the operator's console: binary, analog, slew, and video commands. J.A.M.

N70-16669 Iowa Univ., Iowa City.
STRUCTURE AND ORGANIZATION OF A PATTERN PROCESSOR FOR HANDPRINTED CHARACTER RECOGNITION
Roy James Zingg (Ph.D. Thesis) 1968 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-4295

System structure and organization of a special purpose digital system for implementing experimental handprinted character recognition algorithms is investigated. The primary system objective is the ability to execute a variety of recognition algorithms at a reasonable processing speed with a near minimum cost system. In the system conceived the experimental recognition algorithms are implemented as a series of subroutines stored in an electrically alterable control memory. Character array information, processing parameters, calls on control memory subroutines and character set parameter information will be stored in a thin film scratchpad memory. An electromechanical document reader will sense and digitize character array information. A packaging technique that favors a bus oriented system and the required bit processing capability strongly influenced design decisions. Dissert. Abstr.

N70-16682# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Aachen (West Germany). Inst. fuer Theoretische Gasdynamik.
SYMPOSIUM ON HYBRID COMPUTERS IN AERONAUTICS AND ASTRONAUTICS, PART 1 [SYMPOSIUM HYBRIDRECHNER IN LUFT- UND RAUMFAHRT, 1. TEIL]
A. Kurau May 1969 145 p refs Partly in GERMAN and partly in ENGLISH Conf. held at Meersburg, Ger., 9–11 Oct. 1967 (DLR-FB-69-31; DVL-781) Avail: CFSTI

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1. DESIGN OF HYBRID COMPUTER SYSTEMS W. Ameling (Tech. Univ. Aachen) p 11–28 refs (See N69-16683 05-08)

2. INSTALLATIONS OF HYBRID COMPUTER SYSTEMS A. Kurau p 29–59 (See N70-16684 05-08)

3. TRENDS IN HYBRID COMPUTATIONS W. H. Havranek p 61–74 (See N70-16685 05-08)

4. COMPUTING PERFORMANCE OF HYBRID ANALOG COMPARISON WITH DIGITAL COMPUTERS G. Haussmann (AEG-Telefunken A.G., Konstanz) p 75–86 refs (See N70-16686 05-08)

5. PROGRAMMING OF HYBRID COMPUTER SYSTEMS ON THE BASIS OF PROBLEM-ORIENTED LANGUAGES P. Wiesenthal (AEG-Telefunken A.G., Konstanz) p 87–108 refs (See N70-16687 05-08)

6. HARDWARE AND SOFTWARE DEVELOPMENT FOR THE HYBRID COMPUTER SYSTEM OF THE VEREINIGTE FLUGTECHNISCHE WERKE A. Mund (Ver. Flugtech. Werke, Bremen) p 109–143 (See N70-16688 05-08)

7. NEW DEVELOPMENTS IN HYBRID COMPUTATION A. J. Sutton (Solartron Electron. Group Ltd.) p 143–152 (See N70-16689 05-08)

N70-16683# Technische Hochschule Aachen (West Germany).
DESIGN OF HYBRID COMPUTER SYSTEMS [AUFBAU HYBRIDER RECHENSYSTEME]
W. Ameling *In* DVL Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 1 May 1969 p 1–28 refs In GERMAN (See N70-16682 05-08)
Avail: CFSTI

The properties of hybrid computer systems are described and compared to those of digital and analog computers. The advantage of hybrid computers is primarily their high speed, which makes them particularly suitable for aerospace applications. The individual elements of the analog side of a hybrid computer, analog to digital and digital to analog converters, multiplexer channels, and digital integrators are described. ESRO

N70-16684# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Aachen (West Germany).
INSTALLATIONS OF HYBRID COMPUTER SYSTEMS [INSTALLATIONEN DER HYBRIDEN-RECHNERSYSTEME]
A. Kurau *In its* Symp. on Hybrid Computers in Aeron. and Astronaut. Pt. 1 May 1969 p 29–59 In GERMAN (See N70-16682 05-08)
Avail: CFSTI

A list of hybrid computer installations in the FRG and aborad is presented which contains data on system configuration, including peripheral devices, channels, analog to digital converters, etc. ESRO

N70-16685# Redifon-Astrodata, Ltd., Little Hampton (England).
TRENDS IN HYBRID COMPUTATION
W. Havranek *In* DVL Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 1 May 1969 p 61–74 (See N70-16682 05-08)
Avail: CFSTI

The design of the Applied Dynamics/Four hybrid computer is discussed; in particular, the interface between the analog and digital sections, the use of a logic patchboard, the transfer of information into and out of the computer, validating, solution of problem, and the generation of digital coefficients and functions. ESRO

N70-16686# AEG-Telefunken, Konstanz (West Germany).
COMPUTING PERFORMANCE OF HYBRID ANALOG COMPUTERS AND HYBRID COMPUTERS IN COMPARISON WITH DIGITAL COMPUTERS [DIE RECHENLEISTUNG HYBRIDER ANALOGRECHNER UND HYBRIDER RECHNERSYSTEME IM VERGLEICH ZUM DIGITALRECHNER]
G. Haussmann *In* DVL Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 1 May 1969 p 75–86 refs In GERMAN (See N70-16682 05-08)
Avail: CFSTI

The calculating speed and performance of digital computers with block-oriented programming and hybrid computer systems are compared, taking into account the number of steps in numerical integration and the relationship between accuracy and bandwidth in analog computer elements. The calculating performance of a digital computer is evaluated and is found to be equivalent to a given analog computer. ESRO

N70-16687# AEG-Telefunken, Konstanz (West Germany).
PROGRAMMING OF HYBRID COMPUTER SYSTEMS ON THE BASIS OF PROBLEM-ORIENTED LANGUAGES [DIE PROGRAMMIERUNG HYBRIDER RECHENANLAGEN AU DER GRUNDLAGE PROBLEMORIENTIERTER SPRACHEN]
P. Wiesenthal *In* DVL Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 1 May 1969 p 87–108 refs In GERMAN (See N70-16682 05-08)
Avail: CFSTI

The structure of a program system (RELAY) for use with hybrid computers is described. It consists of a specification part, with name definition, amplifier definition, function generator definition, potentiometer table, network section and pseudo equations. This program can be interfaced with FORTRAN and programmed operators can also be used. ESRO

N70-16688# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
HARDWARE AND SOFTWARE DEVELOPMENT FOR THE HYBRID COMPUTER SYSTEM OF THE VEREINIGTE FLUGTECHNISCHE WERKE [HARDWARE- UND SOFTWARE-ENTWICKLUNG FUER DIE HYBRID-RECHENANLAGE DER VEREINIGTEN FLUGTECHNISCHEN WERKE]
A. Mund *In* DVL Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 1 May 1969 p 109–142 In GERMAN (See N70-16682 05-08)
Avail: CFSTI

A detailed description is given of the structure of a hybrid computer system, which includes a CDC 3200 digital computer

and an analog computer developed from a supplementary hybrid system. The hardware of the hybrid computer, including the interface, the parts used for simulation, interrupt and control lines, and standard circuits are described. The software and user programs, including macros and test programs, are also described. Practical experience of operation is outlined. ESRO

N70-16689# Solartron Electronic Group, Ltd., Farnborough (England).
NEW DEVELOPMENTS IN HYBRID COMPUTATION
A. J. Sutton *In* DVL Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 1 May 1969 p 143-152 (See N70-16682 05-08)
Avail: CFSTI

In view of the difficulties associated with interfacing many different types of analog computers, linkage systems, and digital computers, a new generation hybrid computer system has been developed. Special attention is given to software problems concerning replacement of patchboard by programmed selection of time constants, integrators, etc. ESRO

N70-16691# RAND Corp., Santa Monica, Calif.
APAREL: A PARSE-REQUEST LANGUAGE
R. M. Balzer and D. J. Farber Sep. 1969 38 p refs Supersedes (RM-5611-ARPA: AD-677268
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-694442; RM-5611-1-ARPA; RM-5611-ARPA) Avail: CFSTI CSCL 9/2

The report describes APAREL, an extension to an algorithmic language (PL/I) that provides the pattern-matching capabilities normally found only in such special-purpose languages as SNOBOL4 and TMG. This capability is provided through parse-requests stated in a BNF-like format. These parse-requests form their own programming language with special sequencing rules. Upon successfully completing a parse-request, an associated piece of PL/I code is executed. This code has available for use, as normal PL/I strings, the various pieces (at all levels) of the parse. It also has available as normal PL/I variables, the information concerning which of the various alternatives were successful. Convenient facilities for multiple input-output streams, the initiation of sequences of parse-requests as a subroutine, and parse-time semantic checks are also included. APAREL has proven convenient not only as a general string manipulator but also in building a powerful SYNTAX and FUNCTION macro system, an algebraic language preprocessor debugging system, an on-line command parser, and a translator for Dataless Programming. Author (TAB)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-15515# Technische Hochschule Aachen (West Germany). Lab. fuer Ultraschall.
ELECTRONIC EQUIPMENT AND IMAGE CONVERTER WITH ENLARGED IMAGE FIELD FOR VISUALIZATION OF FAULTS IN MATERIALS Final Technical Report, Jul. 1968-Jun. 1969
R. Pohlman, E. Schatzer, and H. Licht Jun. 1969 50 p refs
(Contract DAJA37-68-C-0668)
(AD-693884) Avail: CFSTI CSCL 13/8

The first part of the report describes an electronic device which enables the application of the pulse-reflex method for the ultrasound image-converting technique. According to the short duration of the sound pulses and a limited scanning velocity the transducer must be scanned with partial lines. By use of a non-linear amplifier the large dynamic range of the vidio signal, caused by mirror effects, is compressed and adapted to the dynamic range of the television screen. The fully transistorized apparatus contains the circuits for the power supplies and the controls of the converter tube, the picture tube, the signal processing device and the transmitter triggering circuit. The second part of the report describes the construction and the development of an image converter tube which, in contrast to tubes formerly built, uses a shell transducer. Its sound frequency is 5 MHz, the diameter of the transducer is 50 mm. Formulas were given about the influence of the geometry of the shell on the mechanical stability and the sound-optical properties. The method for plating the tube front with a gold layer for vacuum tightness is described. Finally, there is a discussion of sound images made by the electronic device in shadowgraph method and pulse-reflex technique. Author (TAB)

N70-15601# Marchetti (J.W.), Inc., Morrisville, Pa.
ANTENNA ARRAY ELEMENT STUDY Final Report
M. Brent Haslam (Ibis Corp.), Vance A. Parker (Ibis Corp.), and Zara Ciscoe Brough (Ibis Corp.) Sep. 1969 182 p refs Prepared in Cooperation with the Ibis Corp.
(Contract F30602-67-C-0146)
(AD-695834; G-185-TR1; RADC-TR-69-230) Avail: CFSTI CSCL 9/5

The report constitutes the Phase II verification of the investigation to develop a Pattern Ratio Technique. The Pattern Ratio Technique was applied to Phase I and the array breadboard model was constructed to verify the theoretical portion of the study. The model is described and measurements incorporated in its design given. Reduced pattern data obtained with the breadboard array at the Test Range is also included. Finally, theoretical phases of the technique are enclosed including backup data. Author (TAB)

N70-15620# Stanford Univ., Calif. Electronics Labs.
A STATE-VARIABLE AND GYRATOR REALIZATION-COMPARISON
R. W. Newcomb 22 Sep. 1969 4 p refs Presented at Western Electron. Show and Conv., San Francisco, Aug. 1969
(Contract F44620-67-C-0001)
(AD-694065; AFOSR-69-2447TR) Avail: CFSTI CSCL 9/3

Gyrator and state-variable methods are carried out for a degree three Cauer response. Element values are given with an orientation toward complete integration such that the methods can be properly compared for integrated circuit design. Author (TAB)

N70-15648# Microwave Associates, Inc., Burlington, Mass.
STUDY OF CYCLOTRON AND SYNCHRONOUS WAVE DEVICES Triannual Report, 1 Mar.-1 Jun. 1969
R. J. Briggs and S. F. Paik Fort Monmouth, N.J. ECOM Sep. 1969 50 p
(Contract DAAB07-68-C-0398)
(AD-695682; OSD-1366; ECOM-0398-3; Rept-3) Avail: CFSTI CSCL 9/1

A theoretical analysis of the beam energy spread induced by transverse-wave interactions is presented. The theory includes effects of finite beam size, space charges and rotation of the beam. A nonlinear theory is also developed to show a power saturation effect in synchronous-wave traveling-wave tubes due to velocity slipping caused by extended traveling-wave interactions. Results of these two theoretical studies point out important practical limitations on the output power and the efficiency of transverse-wave devices. An experimental vehicle designed as a diagnostic tool to investigate various effects theoretically predicted is described. Author (TAB)

N70-15661# Army Foreign Science and Technology Center, Washington, D.C.

DESIGN OF A STATIC FLIPFLOP, WHICH RETAINS INFORMATION WHEN THE CURRENT IS INTERRUPTED

I. A. Kovalchuk 9 Sep. 1969 20 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Radiodelektronika, (USSR), v. 10, no. 5, 1967 p 455–462

(AD-694415; FTC-HT-23-372-69) Avail: CFSTI CSCL 9/5

Design methods for flip flop circuits which retain information during a current interruption are shown. Transient processes which occur when power is applied are analyzed and the results of experimental circuit tests are given. Author (TAB)

N70-15663# Air Force Cambridge Research Labs., Bedford, Mass.

A DIELECTRIC-ROD BACKFIRE ANTENNA

J. A. Strom Aug. 1969 29 p *Its* Instrumentation Papers No. 158

(AD-694073; AFCRL-69-0347) Avail: CFSTI CSCL 9/5

A backfire antenna is described which incorporates a dielectric slow-wave structure in place of the parasitic directors of earlier models. Using previously investigated optimum dimensions, this antenna uses new techniques of energizing in a cross polarized sense. Measurements of far-field patterns, directivity, and isolation between primary planes are given. Author (TAB)

N70-15673# Comitato Nazional per l'Energia Nucleare, Rome (Italy).

THRESHOLD ELEMENTS WITH CAPACITORS AND MOST COMPONENTS

M. Moretti and G. V. Pallottino [1969] 36 p refs

(RT/EL(69)6) Avail: CFSTI

The practical realization of learning control systems can be carried out by means of threshold elements using suitable electronic components, called adaptive components. The characteristics of a MOST and capacitor adaptive component are discussed and the results achieved with an adaptive threshold element using such components are given. Author

N70-15766* Texas Univ., Austin. Informations Systems Research Lab.

CONTINUOUS MATCHED FILTERS FOR DETECTING GAUSSIAN SIGNALS IN GAUSSIAN NOISE

T. L. Henderson and D. G. Lainiotis 1 May 1969 16 p refs

(Grants NGR-44-012-066; Grants AF-AFOSR-67-766E; AF-AFOSR-69-1764)

(NASA-CR-107702; AD-690138; AFOSR-69-1025TR; TM-11) Avail: CFSTI CSCL 09D

The memorandum is a sequal to a paper entitled 'digital matched filters for detecting gaussian noise'. The problem studied was that of finding the best set of k digital filters to process an observed waveform in order to detect a random signal. In this memorandum two extensions are made: (1) the filters are continuous rather than digital (discrete); and (2) it is shown that the optimum set of filters simultaneously optimizes a large class of criteria, including the bayes risk, the bhattacharya distance, and the divergence. Author (TAB)

N70-15772# Air Force Cambridge Research Labs., Bedford, Mass.

PRELIMINARY TESTS OF A CENTER-FED 8000-FOOT VERTICAL HALF-WAVE TRANSMITTING DIPOLE

E. A. Lewis, R. B. Harvey, R. P. Harrison, C. B. Kalakowsky, and V. C. Fields Jul. 1969 81 p

(AD-695477; AFCRL-69-0296) Avail: CFSTI CSCL 9/5

It was demonstrated experimentally that an 8000-foot half-wave antenna-wire, suspended vertically from a helicopter and driven at its center by a battery-powered transmitter, provides an efficient radiating system for frequencies around 60 kHz. In-flight antenna impedance measurements were made in two different ways using telemetry techniques. Supporting information was obtained from a 4000-foot open wire transmission line erected on poles, and from laboratory bridge measurements on short samples of wire. Certain mechanical properties of the wire and the method used for launching the antenna are described. The electric field strengths received on the ground, radiation patterns, radiation efficiency, bandwidth, scattered waves, and atmospheric-electric currents in the antenna, are discussed in detail. Author (TAB)

N70-15794# Electro-Optical Systems, Inc., Pasadena, Calif.

CHARGE-CONTROLLED STORAGE DISPLAY PANEL Final Report, 1 Jul. 1966 – 31 Mar. 1969

R. A. Missman and P. Foote Fort Monmouth, N.J. ECOM Sep. 1969 131 p refs

(DA-28-043-AMC-02482(E))

(AD-695681; EOS-7109-Final; Rept-10; ECOM-02482-F) Avail: CFSTI CSCL 9/5

This report describes the results of a program for the development of a Charge-Controlled Image Storage Panel. This is an electroluminescent display with the intensity of the electroluminescent light controlled by a semiconductor whose conductance is spatially modulated by the field effect control of the carrier density. Image panels were fabricated with no imperfections, such as missing lines and blank spots, in the image. Panel resolution (determined by the closeness of electrode spacing) was increased to 100 lines per inch. Images were stored with mild degradation for periods of up to five days. Coatings for protection of the image from the deleterious effects of water vapor in the atmosphere were developed. While corona erasure was employed for the most part during the program, two techniques for non-corona erasure were investigated. One technique employed the surface properties of an adsorbed layer of alcohol to erase images. The other technique employed controlled charge application by means of a photoconductor. This technique could lead to important improvements on the operating repertoire of the panel such as both positive and negative writing as well as selective writing and erasing. Author (TAB)

N70-15827# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

GRAPHICAL ANALYSIS AND SYNTHESIS OF COMPLEMENTARY MOS CIRCUITS

Dale R. Flournoy (M.S. Thesis) Jun. 1969 116 p refs

(AD-695480; GGC/EE/69-8) Avail: CFSTI CSCL 9/5

Graphical methods of analyzing and synthesizing complementary MOS circuits containing n devices, $n = \text{or} > 2$, are presented. The analysis is carried out by dividing the circuit into n-1 sub-circuits composed either of two devices or of a single device and the previous sub-circuit treated as a single device. The v-i curves of each successive sub-circuit are then graphically determined by overlaying v-i curves of its components until the v-i curves of the entire circuit are determined. The synthesis is carried out by reducing the electronic functions to be performed by a circuit to a set of properties of the v-i curves. The resulting v-i curves are compared with curves produced by known devices known devices and circuits to determine the proper devices and connections. Eleven new versatile complementary MOS circuits developed using these graphical methods are presented with their v-i and transfer curves. Author (TAB)

N70-15850# Technische Hogeschool, Eindhoven (Netherlands). Afdeling Elektrotechniek.

VOLTAGE MEASUREMENT IN CURRENT ZERO INVESTIGATIONS

W. M. C. van den Heuvel and W. F. J. Kersten Sep. 1969 17 p

(TH/69-E-07) Avail: CFSTI

Measurement errors of current and voltage are investigated in cathode ray oscillograph dividing circuits. The ratio between the

absolute values of the primary voltage and the voltage at the oscillograph is described as a frequency dependent quantity, indicative of the dividing circuit quality. Requirements for the divider and the cable, and the fundamental characteristics of the complete circuit are outlined. Among these, two extrema of primary and secondary response peaks limit the useful upper frequency range leading to incorrect interpretation and baseline drift of the records. Balancing of the resonant frequencies depends on placement of the divider in the main circuit. Recommendations for the construction of mixed voltage dividers for voltages up to 100 kv and frequencies from dc to > or = to 20 Mc/s are given. M.H.E.

N70-15863# Stanford Univ., Calif. Stanford Electronics Labs.
STATE-VARIABLE AND GYRATOR REALIZATIONS FOR COMPLETE INTEGRATION: A COMPARISON
M. B. Waldron and R. W. Newcomb. 22 Sep. 1969. 24 p. refs
(Contract F44620-67-C-0001)
(AD-694066; AFOSR-69-2448TR) Avail: CFSTI CSCL 9/5

For complete integration of a given transfer function, the number, size, and spread of components will be of prime interest, in contrast, for example, to sensitivity. To illustrate these properties, a given degree three Cauer response is synthesized in five ways with emphasis upon complete integration. The results, based primarily upon gyrator and state-variable techniques, are readily compared. Author (TAB)

N70-15871 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIMENTAL STUDY OF CURRENT DISTRIBUTION IN A POROUS ELECTRODE
V. A. Panov et al. 21 Jul. 1969. 13 p. refs. In RUSSIAN and ENGLISH. Transl. into ENGLISH from Electrokhimiya (Moscow), v. 5, no. 2, 1969 p. 180 - 184
(NLL-LTI-746-181-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl. 1 NLL photocopy coupons

A model of a two-phase porous electrode is proposed. The model is used for experimental study of current distribution at various values of resistance of the solid and liquid phases and "end-face" current. Good agreement was found between the experimental results obtained and those yielded by the equations of Daniel'-Bek and the equations derived in the present work. It is shown that the greatest uniformity of current distribution in a two-phase porous electrode for any shape of uniform polarization curve is attained when the solid phase of the electrode has a resistance different from zero. Author

N70-15980# Naval Civil Engineering Lab., Port Hueneme, Calif.
A 20-MICROSECOND ASYNCHRONOUS POWER SOURCE TRANSFER SWITCHING SYSTEM Final Report, Nov. 1968 - Jun. 1969
A. A. Mahmoud. Sep. 1969. 26 p. refs
(AD-695370; NCEL-TR-640) Avail: CFSTI CSCL 9/5

A single-phase, 1-kw, 120-volt demonstration model switching system which utilizes power transistors and does not require power source synchronization was developed and laboratory evaluated. This model accomplishes load transfer between two independent power sources at any phase angle and in less than 20 microsec. The utilization of this system in investigating the effects of asynchronous switching on a limited number of electronic equipment indicated that such equipment can tolerate high-speed power source asynchronous switching. Author (TAB)

N70-16024# Naval Research Lab., Washington D.C. Satellite Communication Branch.
THE NRL MICROWAVE SPACE RESEARCH FACILITY: DESIGN AND DEVELOPMENT OF THE 60-FT X-BAND ANTENNA Final Report
Charles A. Bass and David H. Townsend. 11 Aug. 1969. 27 p
(AD-694005; NRL-6921) Avail: CFSTI CSCL 9/5

To extend the Navy's program in satellite communications, a fully steerable 60-ft X-band antenna system having a Cassegrainian configuration was recently completed at the Naval Research Laboratorys (NRLs) Microwave Space Research Facility at Waldorf, Maryland. It is designed for smooth, precise tracking at velocities from 1/10 sidereal rate to 6 deg/sec through the use of a hydrostatic bearing in the azimuth axis and an antibacklash hydraulic drive system. The 60-ft paraboloidal surface is constructed from solid-surface, 2-in. aluminum honeycomb panels with a nominal surface tolerance of 0.019 in. at zenith. The antenna can be operated in five different modes: slew, manual, synchro slaved, digital, and autotrack. In the digital mode, a general-purpose digital computer has been programmed to operate in a real-time, time-shared system for direct digital control of the antenna position, providing capabilities such as program tracking of satellites and automatic scan and acquisition sequences. The instrumentation flexibility of this system is enhanced by interchangeable feeds, a variety of S- and X-band preamplifiers, and a 25-kW X-band transmitter. The acceptance tests plus operational data indicate that the design and development objectives of instrumentation quality and flexibility have been achieved. Author (TAB)

N70-16043*# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
INTERNAL VISUAL WORKMANSHIP STANDARD FOR MICROELECTRONIC DEVICES (NASA STD XX-2) AND TRAINING MANUAL, VOLUME 1
J. Gaffney, W. R. Rodrigues De Miranda, E. J. Rice, and C. D. Root. Sep. 1968. 34 p
(Contract NAS12-691)
(NASA-CR-86304) Avail: CFSTI CSCL 09A

This standard defines the internal visual criteria covering die mounting requirements, surface imperfections, wire bonding, and contamination on the die surface and on all internal areas as it applies to monolithic microelectronic devices for high reliability applications. It provides a set of reject criteria by which the acceptability of device construction and workmanship can be judged. The reject criteria are related to extended device performance. Author

N70-16044*# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
INTERNAL VISUAL WORKMANSHIP STANDARD FOR MICROELECTRONIC DEVICES (NASA STD XX-2) AND TRAINING MANUAL, VOLUME 2
J. Gaffney, E. J. Rice, and C. D. Root. Sep. 1968. 62 p. refs
(Contract NAS12-691)
(NASA-CR-86305) Avail: CFSTI CSCL 09A

This manual provides information pertaining to the physical processes that take place and the manufacturing techniques utilized in the fabrication of semiconductor integrated circuits. A training course outline and schedule is given. Author

N70-16045# Technische Hogeschool, Eindhoven (Netherlands). Afdeling der Elektrotechniek.
SELECTED BIBLIOGRAPHY OF FUSES
L. Vermij, comp. Sep. 1969. 23 p. refs
(TH/69-E-08) Avail: CFSTI

A bibliography was compiled to offer the possibility of a more directed choice in studying the literature dealing with fuses. The papers mentioned in this selected bibliography give more or less an overall picture of current knowledge, possibilities and requirements regarding uses. The papers were arranged according to subject. The A-papers are the most important publications, whereas B-papers are recommended for further study. C-papers are of interest mainly from a historical point of view. Author

N70-16065# Naval Research Lab., Washington, D.C.
SATELLITE TURNSTILE ANTENNAS Interim Report
Stephen Nichols. 6 Aug. 1969. 21 p. refs

(AD-694003; NRL-6907) Avail: CFSTI CSCL 9/5

The construction of an rf anechoic chamber at NRL presented an opportunity to study, in detail, satellite turnstile antennas. This study was conducted in three phases: research, prototype development and testing, and flight model satellite tests. As a result of this program it was found that the satellite size and shape and the rf harness had a profound effect on the pattern. Tests on the flight model satellites confirmed observations made during the research and development phase. Author (TAB)

N70-16160# Naval Civil Engineering Lab., Port Hueneme, Calif.
FORTRAN COMPUTATION OF THE RESPONSE OF AN ELECTRICAL FILTER TO AN ARBITRARY INPUT Technical Note, Jul. 1968 - Aug. 1969
Donald L. Chaffee, Roger D. Benning, and Robert D. Hitchcock Aug. 1969 80 p refs
(AD-694953; NCEL-TN-1046) Avail: CFSTI CSCL 9/5

This report presents a FORTRAN IV computer program for calculating the response of an electrical filter to an arbitrary input, e.g., a transient. The program utilizes the fast Fourier transform, which is a time-saving computational technique for transforming a time function to a frequency function (or vice-versa) by means of discrete Fourier transform. Details are given on the procedure for setting up the card decks, which are used to feed in data on the input waveform and the circuit parameters of the filter. Examples are given, including the case of a hypothetical power-line filter driven by a triangular pulse. Author (TAB)

N70-16211# Harry Diamond Labs., Washington, D.C.
LOW VALUE TANTALUM THIN-FILM RESISTORS
Albert D. Bender and Stuart I. Lieberman Apr. 1969 42 p ref
(AD-695673; HDL-TM-69-11) Avail: CFSTI CSCL 9/1

Low value resistors were fabricated with mean values within about 10 percent of design and with confidence limits (2 sigma) within about plus or minus 20 percent of the mean, which compare favorably with the results previously reported on tantalum thin-film resistors greater than 3.3 kohms. The best resistors were designed with parallel elements having 1/2-mil line widths and an aspect ratio (length/width) of 4. Author (TAB)

N70-16250*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PACKAGING ELECTRONIC CIRCUITRY INSIDE FERRITE POT CORES
J. L. Westrom 10 May 1968 7 p
(NASA-TM-X-63756; I-716-68-247) Avail: CFSTI CSCL 09A

The special construction features of the ferrite pot core are recommeded for the packaging of electronic circuitry which presently houses only the wire - bobbin. The advantages are: (1) The technique affords a logical vehicle for utilizing the latest microcircuit methods for size reduction. The pot core offers a compact, durable, and machinable structure which can be reliably mounted to any material; in addition, an inherent heat sink capability is given through the ferrite material and by means of the aluminum stud through the center of the core. (2) The technique offers small, compact, modular circuits which are usable as building blocks for larger systems. The ferrite material not only shields its internal circuitry from external RFI, but is more effective in reducing internally generated electromagnetic radiation than the toroid core construction. (3) A modular circuit packaged inside the ferrite pot core and placed in a nuclear radiation flux field has built-in protection. The magnetic material of the circuitry becomes an excellent nuclear radiation shield from high energy proton, electron, and gamma radiation. The applicability of this technique to spacecraft circuitry is mentioned. M.H.E.

N70-16335# Defense Documentation Center, Alexandria, Va.
CAPACITOR TECHNOLOGY, VOLUME 1: A DDC BIBLIOGRAPHY, JANUARY 1962 - March 1969
Jul. 1969 203 p refs
(AD-691400; DDC-TAS-69-46-1) Avail: CFSTI CSCL 9/1

The bibliography is a compilation of references on miniature and microelement capacitors formed by deposition of a dielectric substance on a ribbon, sheet, or wafer. Section I pertains to discrete capacitive elements which are found in monolithic or integrated circuits and serve to integrate with other similarly constructed passive and active elements to function as a complete electronic circuit. TAB

N70-16336# Naval Ordnance Lab., White Oak, Md.
A WIDEBAND STRIPLINE SINGLE SIDEBAND MODULATOR
Richard O. Giorgis 30 Jul. 1969 45 p refs
(AD-695365; NOLTR-69-134) Avail: CFSTI CSCL 9/5

The paper presents a stripline single sideband modulator having both wideband carrier and modulation capabilities. Both theoretical and experimental results are presented. Author (TAB)

N70-16345*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF REACTOR RADIATION ON 4.7-VOLT SILICON VOLTAGE-REGULATOR DIODES
Suzanne T. Weinstein, Edward A. Maslowskii and Erich W. Kroeger Washington Jan. 1970 15 p refs
(NASA-TM-X-1930; E-5187) Avail: CFSTI CSCL 09A

Twenty-five silicon voltage-regulator (Zener) diodes were exposed to reactor radiation to a fast neutron fluence of 8.2 × 10 to the 13th power neutrons/sq cm and a gamma dose of 6.3 × 10 to the 7th power rads-carbon. The diodes were electrically energized in three different operating modes during irradiation. The Zener voltage remained constant, and the breakdown knee was somewhat softened. The forward- and reverse-leakage currents increased. The function capacitance remained unchanged. Electrical operating mode did not affect the radiation damage in these diodes. Author

N70-16371# Air Force Cambridge Research Labs., Bedford, Mass.
THE ENHANCEMENT OF ANTENNA IMAGES
F. H. Cleveland and A. C. Schell Aug. 1969 33 p refs *Its* Physical and Mathematical Sciences Research Papers No. 391
(AD-694486; AFCRL-69-0345) Avail: CFSTI CSCL 3/2

Data processing can improve or sharpen the output of a scanning antenna system using the theory of restoration and enhancement. The paper reviews the theory of restoration and explains the theory of enhancement, which matches an autocorrelation function covering the extended spatial frequency range to the restored data without using extrapolation or analytic continuation. The theory is tested using experimental data of solar maps taken by a 28 foot dish at a wavelength of 8 mm. Author (TAB)

N70-16372# Naval Ordnance Lab., White Oak, Md.
A WIDEBAND MICROWAVE COUPLING NETWORK
Alan J. Ramsbotham, Jr. 29 Jul. 1969 37 p refs
(AD-695366; NOLTR-69-133) Avail: CFSTI CSCL 9/1

The paper discloses a recently developed coupling technique applicable to the design of wideband microwave filter networks. Design curves and experimental results are presented and discussed. Author (TAB)

N70-16396# Naval Civil Engineering Lab., Port Hueneme, Calif.
POWER LINE IMPEDANCE DETERMINATION USING THE "THREE VOLTMETER" MEASUREMENT METHOD Technical Note, Jun. - Dec. 1968
Homer A. Lasitter Aug. 1969 28 p refs
(AD-694930; NCEL-TN-1050) Avail: CFSTI CSCL 9/1

One of the problems associated with power line filter

specifications is adequate knowledge of the source impedance into which the filter should be designed. In order to establish an average impedance with high and low bounds, a number of measurements have been made at various Navy installations. The procedure used to determine source impedances utilizes an adaptation of the three voltage method. A known impedance is placed in series with the desired impedance and a measurement voltage, tuned to the test frequency of interest. The magnitude of the impedance is found by comparison of the voltages across the known and unknown impedances. Phase information is obtained by construction of a vector diagram made up of the voltages measured across the known and unknown impedances and the measurement voltage. Author (TAB)

N70-16413# Boeing Scientific Research Labs., Seattle, Wash. Information Sciences Lab.

EFFICIENT COMPUTER AIDED ANALYSIS OF NONLINEAR ELECTRONIC CIRCUITS

R. H. Allen Aug. 1969 56 p refs *Its* Inform. Sci.-35

(AD-694306; DI-82-0893) Avail: CFSTI CSCL 9/5

A digital computer algorithm for analyzing the behavior of nonlinear electronic circuits using the state-space approach is described. The nonlinear, time-varying and adjustable-parameter elements are removed and treated externally to an otherwise linear system. For each varying element a new input and output port of the system are defined. The nonlinearities are described in terms of the state of the system expressed at the output ports to which the nonlinear elements are attached. Author (TAB)

N70-16489# Harry Diamond Labs., Washington, D.C.

EVALUATION OF MICROWAVE ULTRASONIC DELAY LINES

James R. Griffin May 1969 34 p

(AD-693802; HDL-TR-1441) Avail: CFSTI CSCL 9/1

An evaluation of ultrasonic delay lines is presented. Also, a method of computing the loss per transducer is given. Results of measurements made indicate that delay lines having <20 dB insertion loss and bandwidths of >10 percent are feasible. Author (TAB)

N70-16493# Harry Diamond Labs., Washington, D.C.

THEORETICAL PERFORMANCE OF MAGNETOELASTIC DELAY LINES

B. A. Auld Jul. 1969 35 p refs

(AD-695627; HDL-TR-1456) Avail: CFSTI CSCL 9/1

The purpose of the paper is theoretical evaluation of double-ended magnetoelastic delay lines, with particular emphasis on those having magnetization normal to the direction of propagation. Normal magnetization allows an internal field profile that is concave upward, which is necessary in order to have acoustic input and output. Author (TAB)

N70-16500 National Lending Library for Science and Technology, Boston Spa (England).

THE MEASUREMENT OF DIELECTRIC VALUES IN THE 0.4 Hz - 5 TIMES 0.00001 Hz SUBAUDIO RANGE

G. Schweitzer 18 Jul. 1969 8 p refs Transl. into ENGLISH from Russian publ.

(NLL-TRANS-558-(9023.175)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

An apparatus is described which enables dielectric investigations to be performed in the frequency range from 0.4 to 0.00005 Hz. The measuring accuracy is stated. It is demonstrated by an example that the values measured digitally are in good agreement with those obtained by bridge measurements. Author

N70-16512# Argonne National Lab., Ill.

A NEW PULSE MODULATOR FOR THE ZERO GRADIENT SYNCHROTRON LINAC

J. Abraham and N. Sesol *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 94–100 refs Sponsored by AEC (See N70-16501 05-24)

Avail: CFSTI

Design and construction of a 15 MW pulse modulator has begun at Argonne National Laboratory to replace the unit in present use. The unit, which employs a single switch tube, is capable of regulation during 50–200 microsec beam pulses in a regulating loop which includes the entire linac. A dual fast-fault protection system incorporates clamping of the switch tube and a backup system which terminates the drive signal during load faults. Design data and operating characteristics will be discussed. Author (NSA)

N70-16513# Los Alamos Scientific Lab., N. Mex.

FAULT PROTECTION CIRCUITRY FOR THE LASL 201.25-MHz POWER AMPLIFIERS

J. D. Doss *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 101–107 Sponsored by AEC (See N70-16501 05-24)

Avail: CFSTI

Design objectives were: (1) sufficient protection with minimum of downtime for the amplifier, and (2) effective interfacing between fault protection circuitry and computer controls. Low-level fault protection logic, modulator grid-clamp circuit, and crowbar were tested and evaluated. J.A.M.

N70-16519# Los Alamos Scientific Lab., N. Mex.

AUTOMATIC CONTROL OF RF AMPLIFIER SYSTEMS

R. A. Jameson *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 149 158 refs Sponsored by AEC (See N70-16501 05-24)

Avail: CFSTI

Selected amplifiers and components were tested for a complete automatic control system in conjunction with the electron prototype accelerator (EPA). Operation, RF system, transient and steady aspects, and accelerator tank of EPA are briefly discussed. Measurements are being made to study system interactions, nonlinearities, and second-order effects as the basis for final design. Current status of RF control systems and direction of future work are outlined. J.A.M.

N70-16528# Brookhaven National Lab., Upton, N.Y.

DISCUSSION OF H. V. POWER SUPPLY UNITS CONNECTED WITH HIGH GRADIENT TUBES IN LINAC PREINJECTORS

V. J. Kovarik and Th. J. M. Sluyters *in its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 251 268 ref Sponsored by AEC (See N70-16501 05-24)

Avail: CFSTI

Surge resistor selection in an open 750 kV circuit and its consequences in possible bouncer systems are discussed, along with the 850 kV Haefely Cockcroft-Walton characteristics. Results indicate: (1) low terminal capacity is desirable; (2) beam servo loop is on only during pulse; (3) individual gaps have to stand 10 to 20 percent increase in voltage for a short period; and (4) gap capacity should be uniform. Microdischarge current may be limited, and conditions (1) and (2) may be invalidated if a resistor isolates each accelerating gap. J.A.M.

N70-16700*# Martin Marietta Corp., Denver, Colo. Electronics Research Dept.

IN-FLIGHT MAINTENANCE STUDY Final Report

John T. Polhemus, D. Starner, W. Mc Candliss, J. Gusman, and R. Zermuehlen Dec. 1969 147 p refs

(Contract NAS9-8144)

(NASA-CR-102089; MCR-69-598) Avail: CFSTI CSCL 09A

While criteria, guidelines and methods for achieving maintainable systems were evolving, a parallel effort was in progress to test these tools. This was the analysis and subsequent redesign for maintainiability of the Block 2 Apollo guidance and navigation (G&N), stabilization control (SCS), and telecommunications systems. While the primary product of the study was to be criteria and considerations for obtaining maintainable electronics, some of the methods developed during this study were tested on other programs and have proved to be of value. Author

N70-16702 Vanderbilt Univ., Nashville Tenn.
THE PARAMETRIC COUPLING OF THE MODES OF PROPAGATION IN GENERAL TRANSMISSION SYSTEMS
Wen-Pin Ou (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-4647

The number of coupled modes is limited to two. Four types of parametric coupling are analyzed: co-flow difference frequency pumping, co-flow sum frequency pumping, contra-flow difference frequency pumping, and contra-flow sum frequency pumping. The parallel-wire transmission lines are used as the circuit model of the analysis. The analysis is made by means of the ,coupled mode theory. It is found that the solution of the coupled mode equations predicts either power conversion or power gain for the coupled modes. For lossless distributed circuits, the results obtained with two time-varying circuit elements are similar to those with a single time-varying circuit element. But unlike the case of a single time varying circuit element, in which the gain or the rate of power conversion for the case of two time-varying circuit elements can be adjusted either by the pumping power or by the pumping angle. Dissert. Abstr.

N70-16729# Signals Research and Development Establishment, Christchurch (England).
AN RF SPUTTERING SYSTEM FOR USE IN MICROCIRCUIT FABRICATION
I. G. Carver and B. J. Franklin Mar. 1969 23 p refs
(AD-695258; SRDE-69018) Avail: CFSTI CSCL 9/5

A simple diode R.F. sputtering system is described which has been used to sputter amorphous quartz for thin film capacitors. The problem of feeding R.F. power to the gas discharge in the sputtering chamber, and some factors affecting chamber impedance are discussed. Deposition rates of quartz up to 150 pm/s have been achieved, and the distribution of deposit is shown to be determined mainly by current density variation across the axis of the discharge. Author (TAB)

N70-16762 New York Univ., N.Y. School of Engineering and Science.
THE SYNTHESIS OF MICROSTRIP TRANSMISSION NETWORKS UTILIZING SEMICONDUCTOR DIELECTRICS
Anthony W. Cuilwik (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-4559

The development of analytical methods for the design of microwave integrated circuits consisting of microstrip transmission networks containing semiconductor dielectrics is reported. It is shown under what conditions the energy propagating in the networks is almost entirely in the TEM mode. This fact, in conjunction with a conformal mapping technique, permits the characterization of a microstrip transmission line containing a semiconductor dielectric by a simple electrical model. A synthesis technique, based on this model, is presented which enables the design of distributed microwave filters. A uniform transmission line and two wideband microwave bandpass filters were fabricated and measured; there was excellent agreement between the theoretical predictions and the measured data. Dissert. Abstr.

N70-16770 California Univ., Berkeley.
THEORY OF ZIGZAG ANTENNAS
Sing Hoi Lee (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-3645

This thesis presents a detailed investigation of the underlying mechanism of operation for zigzag antennas, which may be used in uniform or log-periodic configurations with or without a reflecting screen. The integral equation technique is used to find the rigorous solutions of the current distributions on these antennas. Through a new decomposition technique the current distributions are analytically separated into forward and reflected components, from which the k-beta diagrams of uniform zigzag antennas can be obtained without calculating very long structures. For the case of log-periodic zigzag antennas, the forward component of the current also gives the characteristic impedance of the antenna, which can only be determined through many measurements or calculations should this decomposition technique not be available. Dissert. Abstr.

N70-16824*# Battelle Memorial Inst., Columbus, Ohio.
POTTING ELECTRONIC MODULES
R. E. Keith Washington NASA 1969 72 p refs Sponsored by NASA
(NASA-SP-5077) Avail: SOD $0.35; CFSTI CSCL 09A

Recent developments in the technology of encapsulating, potting, or embedding electronic modules are covered in this report. Most of the information presented deals with modules constructed from discrete components by welding or soldering techniques. Such modules are typically three dimensional with components stacked like cordwood, or they are planar like printed circuits. The encapsulation of integrated and film-type circuits is mentioned only briefly. Solid resin, foam, and conformal encapsulants are discussed, but only passing references are made to liquid, dry powder, and ceramic encapsulants, because they are seldom used for modules containing active solid-state electronic components. Author

N70-16849# Atomic Energy Commission, New York.
GROUND PLANE PRINTED CIRCUIT BOARDS BY REFRACTED PHOTOGRAPHIC METHOD
F. Wilson May 1969 9 p ref
(HASL-208) Avail: CFSTI

Ground plane printed circuit boards with insulated barriers etched around the conductors have been made from a simple line diagram of the conductor pattern by using refracted light to obtain a sharp image of the outline of the conductors. The line width is controlled by selection and manipulation of the light refractor. The refracted photographic method results in a considerable saving of drafting time in the preparation of the master for the ground plane printed circuit board. Author (NSA)

N70-16850# Battelle-Northwest, Richland, Wash.
EDDY CURRENT NONDESTRUCTIVE TEST TUBING CROSS-SECTION DISPLAY DEVICE
H. L. Libby Aug. 1969 15 p ref
(Contract AF(45-1)-1830)
(BNWL-1158) Avail: CFSTI

Additional test results of an eddy current tubing cross-section display device described in an earlier report are given. The tubing cross-section display device gives a cathode ray tube presentation showing the approximate location of tubing flaws detected by the eddy current method. A multiparameter eddy current tester is used to provide the needed variety and separation of signals, and the method of display is similar to that used in a radar system plan position indicator. Signals resulting from artificial flaws within the tube wall have now been displayed. A composite photograph of the display shows the relative location of outer wall, within the wall, and inner wall artificial flaws in 0.080 in. wall, 3-7/16 in. o.d. type 304 stainless tube. Display circuitry for handling six signal channels has been built. Author (NSA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-15629# University of Southern Calif., Los Angeles. Electronics Personnel Research Group.
RESEARCH IN ELECTRONICS MAINTENANCE AND MAINTAINABILITY, MULTIDIMENSIONAL SCALING, COMPUTER PERSONNEL SELECTION, AND TECHNICIAN TRAINING Final Report, 1 Jul. 1961 - 31 Jul. 1969
Joseph W. Rigney Oct. 1969 44 p refs
(Contract Nonr-228(22))
(AD-695459) Avail: CFSTI CSCL 9/3

Research was performed in four major areas: maintenance and maintainability of electronic equipment, multidimensional scaling, computer personnel selection, and technician training. Examples of research results were criterion measures for computer programmers and systems analysts, and a job-aid and troubleshooting manual for trouble shooting a transceiver. Other significant contributions were the development of quantitative models of the troubleshooting process, the development of an automated procedure for estimating time costs of serial tasks, the application of multidimensional scaling to identifying psychological variables in understanding electronic circuits and in threat evaluation in CIC, the development of job-task performance tests for maintenance of communications and radar equipment, the specification of training objectives for this equipment, and the development of a program for implementing computer-assisted performance training that generates the interaction with the student from models of the tasks to be learned. Author (TAB)

N70-16343# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRANSIENT NOISE IN ELECTRONIC MEASUREMENTS
Henry S. Burden and Donald D. Shear Jul. 1969 22 p
(AD-694377; BRL-1442) Avail: CFSTI CSCL 14/2

The probable sources and couplings of disturbances produced by current transients in the range 10 to the 11th power amperes/second are discussed. Four steps, involving grounding, shielding, damping, and blocking, are detailed as sufficient to exclude noise from oscillographic traces. Author (TAB)

N70-16414 New York Univ., N.Y. School of Engineering and Science.
OPTIMAL CONTROL OF UNSTABLE LINEAR PLANTS WITH INACCESSIBLE STATES
Franklin Dellon (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-4560

A synthesis procedure is presented for the optimal control of time-varying multivariable linear plants. Using the time-domain approach and output vector feedback, it is shown how to find the controller which will optimize the performance of a linear dynamic process relative to a quadratic performance functional when not all the states of the plant are accessible for measurement. The resulting feedback system is asymptotically stable and its performance can be made arbitrarily close to that which results when all states can be measured. The theory is developed for the continuous-time regulator problem and extended to the discrete-time regulator problem and tracking systems. A digital computer program which computes the required gains is included. Dissert. Abstr.

N70-16417 Ohio State Univ., Columbus.
RADIATION FROM A FINITE RIGHT CIRCULAR CONE EXCITED BY CERTAIN SYMMETRICAL SOURCES
Harry Edward Green (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-4896

This dissertation is concerned with radiation from a finite right circular cone which is excited by a monopole protruding from the center of its base and by a circumferential slot containing a uniform, radially directed E field. The cone is assumed to be of a size which places it above the resonance region, making a solution by the geometrical theory of diffraction possible. The problem is considered with the cone first perfectly conducting and then with its curved surface covered with an ablative material. Dissert. Abstr.

N70-16560# Brookhaven National Lab., Upton, N.Y.
FIELD MEASUREMENTS OF VARIABLE BETA MULTI-STEM ACCELERATING STRUCTURE
S. Giordano and J. Hannwacker *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 565-569 refs
Sponsored by AEC (See N70-16548 05-24)
Avail: CFSTI

This paper measures and evaluates the axial electric field distribution of a single and multistem drift tube support for a variable Beta cavity. This model has a much greater change in beta over its length as compared to a realistic cavity design. The changes of the average electric field are caused by a frequency detuning perturbation, and the corresponding improvement one obtains with a four stem drift tube support are compared to a one stem case. The variable beta cavity is made up of different cells each having the same resonant frequency but a different length, resulting in a mismatch of fields between each cell. A consequence of this field mismatch is an intrinsic field variation. Author

N70-16679 Ohio State Univ., Columbus.
ANTENNA MODE ARRAYS
Johnson Jenn-Hwa Wang (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-4993

A general theory of mode arrays, with emphasis on maximizing directivity, is investigated. The distribution of a source can be expanded into a series of natural modes of the structure that is used, e.g., waveguide modes in a cavity-backed slot, and the far-field pattern will be the superposition of patterns due to individual modes. The directivity of a mode array can be maximized by suitable choice of the phase and amplitude of each mode. The present study has generalized the method of Tai and Walter by using complex rather than real mode amplitudes and relaxing a normalization condition. Except for the case of maximization with super-gain constraint, the results are in simple, closed form, and easily can yield numerical results through the use of a computer. The synthesis and excitation of modes in a rectangular waveguide with ground-plane is considered in order to illustrate some of the general principles. A dual-probe method of exciting the waveguide is introduced for broadside designs in an effort to gain better mode control. Dissert. Abstr.

N70-16867 Florida Univ., Gainesville.
PLASMA DIAGNOSTICS AND ELECTRODE MATERIAL RELEASE IN HIGH VOLTAGE VACUUM BREAKDOWN
Tristram Bethea Mc Call, III (Ph.D. Thesis) 1968 209 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-5395

Investigations of material release phenomena for electrodes undergoing high voltage vacuum breakdown were performed. In particular, the quantity of electrode material released for specific conditions was measured. In addition, the characteristics of the release phenomena concerning the material state as well as the

dynamics and direction of the material ejection were determined. The essential element of the experimentation consisted of increasing the voltage across two electrodes in a vacuum chamber until breakdown occurred. Extremely high oscillatory currents were produced by the discharge of energy storage capacitors connected to the electrodes. The investigatory methods included electrical measurements, optical spectroscopy, time resolved and time integrated photography and neutron activation analysis for measurement of released mass. Two experimental devices were designed and built, and provided both qualitative and quantitative data. Dissert. Abstr.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-15557# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A CRITIQUE OF HIGH-PERFORMANCE SHOCK TUBE DRIVING TECHNIQUES
Walter R. Warren and Clarence J. Harris 30 Sep. 1969 57 p refs
(Contract F04701-69-C-0066)
(AD-695814; TR-0066(5240-10)-6; SAMSO-TR-69-332) Avail: CFSTI CSCL 14/2

The various high-performance shock tube driving techniques considered have been grouped as high pressure/high speed of sound conventional drivers, electric and magnetic field interaction drivers, detonation drivers, and those that derive their flow characteristics from the coupling of energy addition and wave processes in an unconventional manner. High performance can be taken to refer to any property of a shock tube flow that is important to a particular study: for example, shock velocity, driven gas temperature, pressure, and density levels, driven gas kinetic to static energy ratio, and uniformity and duration of the driven gas flow. Data from recent references are compared to determine the relative effectiveness of different driving techniques and the predictability of flow properties. Several fluid dynamic problem areas are outlined; requirements for their study in shock driven facilities are discussed and compared with capabilities resulting from the use of various driving techniques. Author (TAB)

N70-15749# Air Force Systems Command, Wright-Patterson AFB, Ohio. Dynamics Lab.
CALIBRATION OF THE AFFDL 50 MEGAWATT ARC HEATED HYPERSONIC WIND TUNNEL WITH A TWO FOOT NOZZLE
Technical Report Sep. 1967–Dec. 1968
James L. Folck and Richard T. Smith Aug. 1969 68 p
(AD-694516; AFFDL-TR-69-36) Avail: CFSTI CSCL 14/2

The study consisted of the experimental investigation of test flow in an arc heated hypersonic wind tunnel. These tests utilized a high voltage DC arc heater which operated at input powers in excess of 50 megawatts and provided reservoir pressures ranging from 100 to 1500 psi and bulk enthalpies from 1500 to 4000 BTU/lb. Local free stream measurements of pitot pressure, mass flux, stagnation point heat transfer rate and wall static pressures were obtained at the exit of a nominal two-foot diameter conical nozzle. Stagnation enthalpy profiles at the nozzle exit became peaked at high stagnation pressures. From these data, center line enthalpies as high as 6500 BTU/lb were indicated in the flow. Selective comparisons between one-dimensional expansion theory and experiment are presented. At a reservoir enthalpy of approximately 2500 BTU/lb and for stagnation pressure in excess of 500 psi the expanded flow data were in good agreement with equilibrium expansion theory. However, below 500 psi the data compared more closely with nonequilibrium theory with the flow frozen downstream of the nozzle throat. Author (TAB)

N70-15754# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
SHOCK AND CURRENT-SHEET SEPARATION IN MAGNETIC SHOCK TUBES
F. Y. Sorrell 1969 13 p refs
(Contract DA-31-124-ARO(D)-139; Grant NSF-GK-1202)
(AD-695293; Rept-4445-143-P) Avail: CFSTI CSCL 14/2

The problem of separation of a shock wave from the current driving it, is experimentally investigated over a wide range of Mach numbers in a single gas. In order to do this, a parallel plate shock tube was developed which produces repeatable shocks in hydrogen from Mach 20-180 at initial pressures from 75-460 microns Hg. In the present work, no preheating or external magnetic fields were used and the shock is completely collision dominated. The shock-wave and current-sheet trajectories were determined by piezoelectric pressure probes and magnetic pickup loops, respectively, and separation of the shock wave from the driving current was measured directly at speeds above 8.0 cm/microseconds and initial pressures above 250 microns Hg. Experiments were performed at speeds up to 22 cm/microseconds at lower pressures, but separation was not observed at these conditions. The electron temperature behind the shock and within the current layer was determined by using the ratio of continuum intensities across the Balmer series limit, and these temperature measurements were used in connection with the other data to explain most of the observed results. The data are also used to examine the applicability of the skin-depth model and shock-formation theory in predicting separation in magnetic shock tubes. Author (TAB)

N70-15785*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF A METHOD FOR ESTABLISHING PREIONIZED CURRENT PATHS IN TRIGGERING ARC-TYPE FACILITIES
George Lee Maddrea, Jr. (M.S. Thesis - Virginia Univ.) Jun. 1968 79 p refs
(NASA-TM-X-61532) Avail: CFSTI CSCL 14B

The various aspects of a technique to establish a long (up to 4 feet) ionized current path used to trigger arc type facilities are presented. The technique applies to shock tubes and tunnels wherein the driver gas is arc heated by discharging a large capacitor bank into the driver gas. The technique specifically is the high voltage (up to 60 kV) ionization of a trigger wire, used to trigger a moderate voltage (10 kV) energy storage capacitor bank. The investigation involves an experimental analysis and feasibility study with particular attention on maximum arc length, minimum trigger voltage, minimum triggering time, and arc resistance as a function of arc length. Trigger wires of enamel coated copper, tinned copper, bare copper, and a bimetallic composite of palladium and aluminum were used under a nitrogen environment. Author

N70-15862# Naval Ordnance Lab., White Oak, Md.
A COMPARISON OF EXPLOSIVES IN A CONICAL SHOCK TUBE
Michael M. Swisdak, Jr. Apr. 1969 35 p refs
(AD-694028; NOLTR-69-61) Avail: CFSTI CSCL 19/1

Experiments were performed to determine whether or not the 180-foot conical shock tube facility located at the Naval Ordnance Laboratory can be used to determine free-air equivalent weights for several test explosives. The explosives tested were H-6, TNT, pentolite, and TNETB. The rankings of explosives as determined in the CST agree with the rankings in free air. Numerical values

of equivalent weights vary with pressure, but even so the values obtained in the CST do not reproduce the single number usually cited for equivalent weights determined in free air using conventional methods. The variations are believed to be real and presently are thought as likely to represent an uncertainty in the conventional concept of equivalent weight just as much as a fundamental limitation of the conical shock tube. Analysis continues to resolve these differences. Author (TAB)

N70-16123# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
THE PILOT HYPERSONIC WIND TUNNEL OF THE DVL [DER HYPERSCHALLIPILOTKANAL H1 DER DVL]
Heinrich Pfeiffer, Erich Will, and Heinz-Dieter Distelrath Jul. 1969 53 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-44; DVL-891) Avail: CFSTI

The design and test operation of a hypersonic wind tunnel is described. A particular problem was posed by the air heating equipment, for which two designs were tested. A Kanthal-tube heater finally proved satisfactory. The diffuser, safety precautions, and the results of pressure and temperature measurements are also described. Author (ESRO)

N70-16126# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
ENVIRONMENTAL EFFECTS ON AIRPORT PAVEMENT GROOVE PATTERNS Final Report
George A. Kilpatrick Jun. 1969 47 p refs
(AD-694002; FAA-RD-69-37) Avail: CFSTI CSCL 1/5

Results of installing different groove patterns on a variety of asphalt and concrete taxiways at airports with varying climatic regimes are presented. Methods and procedures effecting the installation of groove patterns in airport pavements are discussed, as well as the resulting changes in the groove patterns over the observation period of seven to eighteen months. Some deterioration of grooves occurred in the taxiways with asphalt surfaces under high temperature conditions. Recommendations based on these tests are presented for future grooving projects. Author (TAB)

N70-16131*# Techtran Corp., Glen Burnie, Md.
A METHOD FOR EVALUATING THE EFFECTIVENESS OF BASIC RESEARCH LABORATORIES [UNE METHODE POUR MIEUX JUGER DE L'EFFICACITE DES LABORATOIRES DE RECHERCHE FONDAMENTALE]
Dominique Verguese Washington NASA Jan. 1970 5 p Transl. into ENGLISH from Le Monde (Paris), 18 Dec. 1969 p 17
(Contract NASw-1695)
(NASA-TT-F-12814) Avail: CFSTI CSCL 14B

In an effort to evaluate the output of several French Research Laboratories, a study was made of the number of articles published by each laboratory, and more particularly of the number of times the published works of each laboratory were used as bibliographic references by other scientists. It was found that the number of publications from a laboratory does not correlate to the size or budget of the laboratory in France, although it generally does in United States; however, the number of citations credited to a laboratory did seem to correlate to other measures of the quality of work performed by the laboratory. Author

N70-16178# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
ACTIVITIES OF THE NATIONAL LABORATORY OF FRASCATI FROM 1 JULY 1967 – 30 JUNE 1968 [ATTIVITA' DEI LABORATORI NAZIONALI DI FRASCATI DAL LUGLIO 1967 AL 30 GIUGNO 1968]
Dec. 1968 27 p refs In ITALIAN; ENGLISH summary *Its* Notiz. No. 19
(LNF-68/80) Avail: CFSTI

The research activity of this laboratory is summarized as follows: (1) completed experiments, and experiments in progress at the electrosynchrotron, (2) experimental apparatus for Adone tests with cosmic rays, and synchrotron beams, (3) Adone group project, (4) Leale project, (5) technical and instrumental research activities, and (6) other research. Author

N70-16409# Federal Aviation Agency, Atlantic City, N.J. National Aviation Facilities Experimental Center.
A METHOD FOR COMPUTER SIMULATION OF AIRPORT SURFACE TRAFFIC Final Report
Edward J. Dowe Oct. 1969 73 p refs
(AD-694958; NA-69-47) Avail: CFSTI CSCL 1/2

A method of simulating airport surface traffic using a fast-time digital simulation technique is presented in the report. The control process that regulates airport traffic (both aircraft and ground vehicles) is described, and it is proposed that the airport surface environment be handled by taxiway and terminal subsystems. A method of approach is described for generation of the traffic samples, route selection, conducting the simulation, and validation of its results. Author (TAB)

N70-16502# Los Alamos Scientific Lab., N. Mex.
MECHANICAL DESIGN LASL LINAC STRUCTURES: (LAMPF)
H. G. Worstell *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 1–16 Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

The LASL linac consisting of two basic types of accelerating structures, the 201 MHz drift tube linac and the 805 MHz side coupled system, is described. Some engineering differences are compared between this and other accelerators. J.A.M.

N70-16503# Brookhaven National Lab., Upton, N.Y.
THE BROOKHAVEN 200 MeV LINAC INJECTOR CONSTRUCTION PROGRESS REPORT
P. Grand *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 17–29 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

Construction progress of the 200 MeV linac injector for the Brookhaven alternating gradient synchrotron is reviewed along with RF systems for powering the accelerator at 201.25 Mc/sec. The cavity design of the linear accelerator was completed; control systems and beam monitoring designs and systems analysis were initiated. A short column prototype injector is being tested and will be installed on the 50 MeV linac. Work in structures development and beam dynamics is continuing. J.A.M.

N70-16504# National Accelerator Lab., Batavia, Ill.
MECHANICAL DESIGN FEATURES OF THE NAL 200 MeV LINAC INJECTOR
J. O'Meara and M. Palmer *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 30–40 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

The design characteristics of a 200 MeV linear accelerator for use as an injector for the NAL 200-GeV synchrotron are described. It is noted that the linac is similar to the linac being constructed at Brookhaven National Laboratory. The design characteristics discussed are the drift tubes, alignment fixtures, and RF cavity. NSA

N70-16510# Los Alamos Scientific Lab., N. Mex.
LAMPF 200-MHz POWER SOURCES
J. R. Faulkner and T. J. Boyd, Jr. *In* Brookhaven Natl. Lab. Proc.

of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 87 - 90 Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

The Alvarez section of the proton linac for the Los Alamos Meson Physics Facility was found to require three 3 MW and one 300 kW, 200-MHz rf power sources. Power delivered to the accelerator tanks and controlled over a dynamic range of approximately 30 percent while maintaining a field amplitude tolerance of approximately + or - 1.5 percent with a phase tolerance of approximately + or - 2 deg is reviewed. The minimum RF duty factor (DF) requirement is 8.4 percent (for a 6 percent DF beam) with a design capability of 14.4 percent is described as well as moderate peak but high average power requirements with an impact on the design and engineering of RF amplifier cavities and peripheral circuitry. Author

N70-16511# Los Alamos Scientific Lab., N. Mex.
HIGH DUTY FACTOR MODULATOR FOR LOS ALAMOS MESON PHYSICS FACILITY
T. G. VanVessem *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 91 - 93 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

A modulator utilizing either two Machlett 7482-PV triodes or two ITT 7560 triodes was constructed and tested for high duty factor requirements with elimination of modulator tube grid emission. A simplified schematic of the modulator system is given. J.A.M.

N70-16568# European Organization for Nuclear Esearch, Geneva (Switzerland).
A 3 MeV EXPERIMENTAL PROTON LINAC: DESIGN, CONSTRUCTION AND PROPOSED EXPERIMENTS
E. Boltezar, H. F. Malthouse, and D. J. Warner *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 626 - 634 refs (See N70-16548 05-24)
Avail: CFSTI

The design characteristics, construction, and proposed experiments of an experimental 3-MeV proton linear accelerator are discussed. The linac was proposed as a research facility eventually leading to an improved proton injector design having more protons per main machine pulse and better quality, i.e., reduced emittance. NSA

N70-16569# Los Alamos Scientific Lab., N.Mex.
DESIGN AND INITIAL PERFORMANCE OF A 20 MeV HIGH CURRENT SIDE COUPLED CAVITY ELECTRON ACCELERATOR
E. A. Knapp and W. J. Shlaer *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 635 - 659 refs (See N70-16548 05-24)
Avail: CFSTI

An electron prototype accelerator is described for investigating features of a meson factory project. The project is to be used for generating extremely intense pion and muon beams for elementary particle and nuclear structure research. The physical features and construction time schedule of the linac site are illustrated. In the meson factory project acceleration from 100 to 805 MeV will be achieved in 45 side-coupled accelerator tanks, each driven by a 1.25 MW klystron tube which has automatic phase and amplitude control circuitry to maintain the coherence of the accelerating fields in the accelerator. The electron prototype accelerator will be used to study the properties of the side-coupled standing wave accelerator tanks in an environment and with constraints on its operation similar to those imposed by the meson factory project. The electron prototype accelerator is compared with other electron linacs to illustrate the features of the meson factory project. R.B.

N70-16570# Commissariat a L'Energie Atomique, Saclay (France).
THE NEW SATURNE INJECTOR STATUS REPORT ON THE 20 MeV LINAC
Jm. Lefebvre and M. Prome *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear accelerator Conf., Part 2 May 1968 p 660 - 672 refs (See N70-16548 05-24)
Avail: CFSTI

The proton linear accelerator, new injector for the Saturne synchrotron is an Alvarez structure, with a final energy of 20 to 20.6 MeV, and an input energy of 750 keV. Maximum repetition rate is 1 Hz. The linac is now completely assembled; all main equipments are either ready to be used or being checked. Details are given on some particular aspects of this linear accelerator; technology, accelerating cavity, rf power supply and expected beam behavior. Author (NSA)

N70-16572# European Organization for Nuclear Research, Geneva (Switzerland).
CERN PS 50 MeV LINAC PROGRESS REPORT
C. S. Taylor, J. Huguenin, F. Block, F. Chiari, and P. Tetu *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 694 - 705 refs (See N70-16548 05-24)
Avail: CFSTI

The high gradient preinjector (E = 4.5 MV/m) has been operating with the 50 MeV linac and the PS for a period of 2 years. The operational behavior of the ion source and accelerating tube are described. The behavior of the beam in the 50 MeV accelerator is then discussed in the light of recent experiments. Finally a brief account is given of the state of beam-loading compensation, and of plans for the future compensation of long beam pulses required by the PS Improvement Program. Author (NSA)

N70-16573# European Organization for Nuclear Research, Geneva (Switzerland).
REPORT ON THE ITEP 24.6 MeV AND SERPUKHOV 100 MeV LINACS
C. S. Taylor *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 706 - 712 refs (See N70-16548 05-24)
Avail: CFSTI

In April 1967, the 24.6 MeV proton linac injector of the Moscow 7 GeV PS produced 130 mA beam pulses after a few months of tuning-up. In February 1968, the 100 MeV injector of the Serpukhov 70 GeV PS also produced a high intensity beam (100 mA) after only 6 months of adjustment and trimming. Some of the details of these machines as given by Professor Kapchinskij during a visit to CERN in Feb. 1968, together with some information gathered by the author during a visit to these machines in Nov. 1967, are reported. Author (NSA)

N70-16851# Arnold Engineering Development Center, Arnold Air Force Station. AERO, Inc., Arnold Air Force Station, Tenn. Von Karman Gas Dynamics Facility.
DESIGN OF A WIND-TUNNEL ROLL-DAMPING BALANCE INCORPORATING EXTERNALLY PRESSURIZED GAS BEARINGS OPERATING AT LARGE FILM REYNOLDS NUMBERS Final Report, Aug. 1966 - Aug. 1969
G. E. Burt (M.S. Thesis - Tenn. Univ.) Oct. 1969 109 p refs Submitted for publication Prepared by ARO, Inc.
(Contract F40600-69-C-0001)
(AD-694502; AEDC-TR-69-204) Avail: CFSTI CSCL 14/2

A roll damping, wind tunnel balance consisting of journal and thrust gas (N2) lubricated bearings was designed for use in the von Karman Gas Dynamics Facilitys continuous flow tunnels at the Arnold Engineering Development Center. The balance was designed to be contained in a space envelope of 2.5 inches in diameter and 8.0 inches long. It was required to support a radial load of 350 pounds located plus or minus 2 inches from the journal bearing center and a thrust load of 150 pounds. In order to meet these specifications, the bearings had to be designed with large gas film Reynolds numbers where the assumptions of laminar flow and negligible inertia of the gas used in lubrication theory may

be invalid. An experimental investigation of the bearing resulting from the initial design showed it to have a turbulent gas film which caused an unexpected detrimental effect on load capacity. A more thorough theoretical analysis was conducted to determine the effects of turbulent flow on gas bearing load capacity. Another bearing was designed and fabricated to operate in the laminar flow regime which improved the operating characteristics and was in good agreement with laminar flow theory. Author (TAB)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-15510# Academia R. P. R., Bucharest.
INTRODUCTION ON HYDRODYNAMICS IN POROUS BODIES [INTRODUCERE IN HIDRODINAMICA CORPURILOR POROASE]
St. I. Gheorghita 1969 210 p refs In RUMANIAN; ENGLISH summary
Avail: CFSTI

Basic equations are presented for the motion of free fluid (the fluid in the exterior of the porous body) and of the filtration fluid as well as the matching conditions. The hydrodynamic action on the porous bodies is calculated for homogeneous and non-homogeneous bodies of type 2, and, in the plane case, a generalization of certain formulas is obtained. The motion of perfect fluids is studied in the presence of a body or several bodies, homogeneous non-homogeneous. Several examples are given for irrotational and slightly rotational motions. The slow motion of Newtonian fluids is considered, when in the exterior of the body the motion is described by the linearized Stokes equations or Oseen's equations. Motion in the presence of thin bodies is considered by using the method of expansion in terms of the characteristic filtration coefficient, as well as by an approximate matching condition. Author

N70-15539# Avco-Everett Research Lab., Everett, Mass.
SPECIES CONCENTRATION DECAY IN A TURBULENT BOUNDARY LAYER
George W. Sutton and Harvey Kaye Jul. 1969 57 p refs
(Contract DAAH01-68-C-2101)
(AD-694362; RR-335) Avail: CFSTI CSCL 20/4

The streamwise decay of the flux of a chemical species in a turbulent boundary layer with a catalytic wall and zero concentration in the free stream is considered; as occurs, for example, in the boundary layer of a slender blunted cone where the chemical species are created at the nose and swallowed by the boundary layer downstream. First, to compare with previous work on related problems for incompressible flows, a simple power law for the velocity profile was used. For a shear stress normal profile assumed constant an analytical solution is obtained with a flux decay exponent of -0.1. However, that assumption leads to a concentration profile about twice as thick as the boundary layer thickness. The use of a shear stress profile which decreases in the normal direction leads to an exponent of -0.2. The extensions to more complex velocity profile expressions and compressible flow are given. Author (TAB)

N70-15585# Bangalore Univ. (India). Coll. of Engineering.
THREE DIMENSIONAL FLOW BETWEEN A ROTATING AND A STATIONARY DISK WITH A UNIFORM SUCTION AT THE STATIONARY DISK
N. Rudraiah and M. G. Geetha Feb. 1969 13 p refs Sponsored in part by CSIR
(PGSAM-6) Avail: CFSTI

Three dimensional steady flow of an incompressible viscous fluid between two parallel circular disks, one rotating and another stationary is investigated with a uniform suction at the stationary disk. Solutions for the Navier Stokes equations are obtained and the expressions for the velocity, pressure coefficient and skin friction are given and are compared with the solutions based on the assumptions of creeping flow. Author

N70-15586# Bangalore Univ. (India). Coll. of Engineering.
FLOW OF A CONDUCTING FLUID BETWEEN POROUS DISKS FOR LARGE SUCTION REYNOLDS NUMBER
N. Rudraiah and M. G. Geetha Dec. 1968 10 p refs Sponsored in part by CSIR
(PGSAM-4) Avail: CFSTI

The magnetohydrodynamic laminar flow between two parallel porous disks is examined for large suction Reynolds number and arbitrary Hartmann number. The equations of motion are solved using the singular perturbation technique and the expressions for velocity, pressure and shear-stress distributions are obtained. Author

N70-15607*# Pennsylvania State Univ., University Park. Coll. of Engineering.
SYSTEMS AND CONTROLS LABORATORY
Apr. 1969 30 p refs Sponsored in part by Bell Telephone Labs. and Optimizer Control Corp.
(Grant NGR-39-009-023)
(NASA-CR-107692; PB-186303; RR-9) Avail: CFSTI CSCL 13G

Contents: Spreading of jets in fluid amplifiers; Thermal switching of jet flows; Fluidics reference center; Nozzle thrust modulation by vortex generation; Oscillating vane-digital flow rate sensor; Fluid jet amplifier dynamics; Analysis of simplified linear model for fluid transmission lines; Fluid line dynamics; Optimizer research; Helmholtz resonator response with FM pressure signals; Analog amplifier dynamic response using hydraulic oil; Hydraulic stepping motor; The control area as a basis for self adaptive optimal control; and Participation in IFAC fluidics symposium in London England November 1968. USGRDR

N70-15626# Bangalore Univ. (India). Coll. of Engineering.
HYDROMAGNETIC STABILITY PROBLEM
N. Rudraiah and B. V. Mariyappa Jan. 1969 13 p refs
(PGSAM-5) Avail: CFSTI

Magnetohydrodynamic equations in cylindrical coordinates, are derived using the theory of complex variables. Using these equations the stability of uniform incompressible conducting liquid between two rotating cylinders with an applied axial magnetic field is investigated. It is shown that the fluid is stable if $S > or = 2$ where S is Alfven number and a bound for amplification factor is derived. Author

N70-15631# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
NUMERICAL ANALYSIS OF VISCOUS ONE DIMENSIONAL FLOWS
Gino Meretti and Manual D. Salas Jul. 1969 50 p refs
(Contract Nonr-839(34))
(AD-693974; PIBAL-69-27) Avail: CFSTI CSCL 20/4

The flow of a viscous, heat-conducting gas produced by an accelerating piston is analyzed numerically. The formation of a shock in a viscous flow is studied. A discussion of accuracy and practicality of a numerical analysis of the problem is given. It is concluded that, although very accurate results may be obtained, in principle, regardless of the Reynolds number of the flow, the assumption of a shock as a sharp discontinuity is the only practical way to handle flows whose Reynolds number per unit length is higher than 100. Author (TAB)

N70-15658# Illinois Univ., Urbana. Coordinated Science Lab.
INFINITELY STRONG SHOCK STRUCTURE IN A BINARY GAS MIXTURE
E. Y. Yu Oct. 1969 26 p refs
(Contracts DAAB07-67-C-0199; N00014-67-A-0305-0001)
(AD-695765; R-439) Avail: CFSTI CSCL 20/4

The problem of infinitely strong shock structure in a binary gas mixture is formulated using a bimodel approximation for each gas constituent. The bimodel consists of a delta function for the hypersonic flow upstream and a nonsingular function for the hot flow downstream. The Boltzmann equations are split into four equations. Under the local Maxwellian approximations for the nonsingular functions and an approximations on the force constants in the molecular interaction the problem is reduced to a numerical integration of three moment equations involving three nondimensional parameters, namely, the mass ratio, the number density ratio, and the cut-off parameter ratio. The behavior of the singular points of the system of three moment equations at plus or minus infinity is analyzed, and a numerical integration is proposed. Author (TAB)

N70-15660# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
VISCOUS FLOW ALONG A CORNER. PART 2: NUMERICAL SOLUTION OF CORNER LAYER EQUATIONS
Stanley G. Rubin and Bernard Grossman Aug. 1969 42 p refs
(Contract AF 49(638)-1623)
(AD-695829; PIBAL-69-33; AFOSR-69-2144TR) Avail: CFSTI CSCL 20/4

Solutions for the viscous incompressible flow along a right-angle corner were found by a method of successive iteration. The algebraic nature of the asymptotic flow field has been utilized to provide boundary conditions for the numerical analysis. One arbitrary constant appearing in the asymptotic series has been determined by the elimination of interior mass sources that appear as a result of any inaccuracy in the value of this constant, allowing additional mass to cross the outer boundary. The numerical solution shows a swirling flow in the corner but a closed vortical pattern is not established. Author (TAB)

N70-15665# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical and Aerospace Engineering.
SUPERSONIC TURBULENT FLOW REATTACHMENT DOWNSTREAM OF A TWO-DIMENSIONAL BACK STEP
D. C. Reda and R. H. Page May 1969 138 p refs
(Contract F44620-68-C-0018; Proj. THEMIS)
(AD-694108; RU-TR-125-MAE-F; AFOSR-69-1592TR) Avail: CFSTI CSCL 20/4

A theoretical and experimental treatment of the reattachment of a two-dimensional, supersonic, turbulent separated flow is presented. A control volume in the reattachment region is analyzed, in order to predict the reattachment point location, pressure, and pressure gradient. Detailed experimental measurements were taken in the separated and reattaching flow regions, downstream of a two-dimensional backstep. A free stream approach Mach number of 3.05, and a free stream Reynolds number of 2.0 to 2.5 x 10 to the 7th power per foot were used. A continuous static pressure distribution was measured along the reattachment surface. The reattachment point was located by the orifice dam technique, the flush mounted pitot probe technique, and water injection-tracer techniques. The corner flow region was probed and lip shock effects on the mixing and reattachment regions were noted. Boundary layer profiles were taken throughout the rehabilitation region. The theoretical predictions and the experimental data exhibited close agreement. Author (TAB)

N70-15684# Bangalore Univ. (India). College of Engineering.
THREE DIMENSIONAL MAGNETOHYDRODYNAMIC FLOW BETWEEN A ROTATING AND A STATIONARY DISK WITH UNIFORM SUCTION AT THE STATIONARY DISK
B. C. Chandrasekhara and N. Rudraiah May 1969 19 p refs
(PGSAM-9) Avail: CFSTI

The flow of a conducting fluid between a rotating and a stationary disk in the presence of a transverse magnetic field and with a uniform suction at the stationary disk is discussed. The equations of motion are solved by a regular perturbation method for small suction Reynolds number. It is observed that for a given suction Reynolds number, the azimuthal component of velocity is greatly influenced by the uniform transverse magnetic field than the other two components. The average normal force on the stationary disk and the torque on the rotating disk increase with increase in Hartmann number and the opposite behaviour is observed of the torque on the stationary disk. Author

N70-15710# Bureau of Mines, Morgantown, W. Va. Petroleum Research Lab.
FLUID FLOW IN CHANNELS, CAPILLARIES, AND POROUS MEDIA UNDER THE INFLUENCE OF AN ELECTRIC FIELD
L. C. Headley, C. I. Pierce, and W. K. Sawyer Jan. 1970 41 p refs
(BM-RI-7342) Avail: Issuing Activity

A series of exploratory tests was conducted to determine the effects of steady electric fields on fluid flow and streaming potential in narrow passages and porous media, the effects of steady electric fields on fluid interfaces, and the influence of internal voltages on fluid flow in a porous porcelain sample. Voltages greater than about 5 kilovolts were found to influence liquid droplets emanating from a capillary tube. Solutions of polyethylene oxide and polyacrylamide in water exhibited widely different behavior than that of other liquids tested. Liquid – liquid displacement tests in porous samples to determine the influence of high voltage applied to the displacing liquid on flow rates and recovery gave no significant differences. No consistently measurable effects were noted, either on flow rate or streaming potential, when an electric field was applied transverse to the direction of flow in porous media and in narrow rectangular or cylindrical channels. Experimental values of formation factor and streaming potential for a porous porcelain sample agreed qualitatively with those calculated from electrokinetic theory for ultrafine capillaries. Author

N70-15721# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A PRELIMINARY NOTE ON BOUNDARY LAYER TRANSITION ON A FLAT PLATE IN THE LOUGHBOROUGH UNIVERSITY GUN TUNNEL
E. R. Bergstrom Sep. 1969 19 p
(TT-6912) Avail: CFSTI

The results of an experimental investigation into the variation of the beginning of transition Reynolds number with unit Reynolds number in the range 3 × 10 to 5th power to 9 × 10 to 5th power per inch, is presented. The time variation in the transition position during a test and the effect of model location are also considered. The tests show that it is possible to generate a naturally transisting boundary layer on an 8 inch chord sharp leading-edge flat plate in a gun tunnel for P sub 4 less than or approximately equal to 1500 p.s.i.a., the trends in the main results being broadly in agreement with those of other workers. Author

N70-15723# Royal Aircraft Establishment, Farnborough (England). Ministry of Technology.
BOUNDARY CONDITIONS IN THE PRESENCE OF OBLIQUE REACTION WAVES IN SUPERSONIC FLOW [RANDBEDINGUNGEN BEI SCHIEFEN REAKTIONSFRONTEN IN UBERSCHALLSTROEMUNG]
Fritz Bartlma Apr. 1969 21 p refs Transl. into ENGLISH from Zeits. fur Flugwissenschaften, (German), v. 16, no. 12, 1968 p 437 - 444 *Its* Library Transl. No. 1358
Avail: CFSTI

A reaction wave is defined as a zone of finite thickness with heat addition or subtraction caused by a chemical reaction. As it is well known, the flow is deflected in the case of an oblique reaction wave. In spite of this fact, the boundary conditions at a wall in a supersonic flow can be satisfied by merely gasdynamic considerations without assuming separation of the flow. This is shown for some typical cases. Author

N70-15726# Lockheed Missile and Space Co., Sunnyvale, Calif.
THREE-DIMENSIONAL SUPERSONIC FLOW AROUND BLUNT BODIES
Iu. N. D'iakonov et al [1969] 8 p refs Transl. into ENGLISH from Problemy Gidrodinamik i Mekaniki Sploshnoi Sredy, (Moscow), 1969 p 213 - 220
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

Supersonic gas flow was investigated at an angle of attack around bodies of segmental shape, cones with spherical bluntness, and bodies with a break in the contour generator. Results illustrate the presence of reduced pressure zones, the nature of entropy layer formation as a function of body length, and the nature of relative drag in hypersonic flows. The mesh method was used to obtain results and compute the spatial flow around blunt bodies by equilibrium and perfect gases. J.M.C.

N70-15740# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CONSTITUTIVE EQUATIONS FOR THE FLOW OF A SIMPLE FLUID THROUGH A POROUS BODY UNDERGOING FINITE DEFORMATIONS, JUNE - JULY 1969
G. Aguirre Ramirez Nov. 1969 45 p refs
(HREC-6-79-69-4; LMSC/HREC-D149233) Avail: CFSTI

In this report the constitutive equations for the flow of fluids through a porous body undergoing large elastic deformations are postulated. Using an entropy inequality proposed earlier by the author, restrictions on the postulated constitutive equations are found. In addition restrictions due to frame indifference and material symmetrics are found. Author

N70-15745*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF AVAILABLE INFORMATION ON REYNOLDS ANALOGY FOR ZERO-PRESSURE-GRADIENT, COMPRESSIBLE, TURBULENT-BOUNDARY-LAYER FLOW
Aubrey M. Cary, Jr. Washington Jan. 1970 19 p refs
(NASA-TN-D-5560; L-6648) Avail: CFSTI CSCL 20D

An analysis of available experimental data defining the Reynolds analogy between turbulent heat transfer and skin friction has been conducted. For Mach numbers greater than 5, there are insufficient data and too much scatter in the available data to empirically define within desirable accuracy limits the functional dependence of the Reynolds analogy factor on the boundary variables. For Mach number less than 4 or 5 and near-adiabatic wall conditions, an empirical definition of the Reynolds analogy factor appears to be valid as a mean of the data; no simultaneous measurements of skin friction and heat transfer were found for this lower Mach number range. There is an indication from the experimental data that decreasing the ratio of wall-to-local-total enthalpy decreases the Reynolds analogy factor. Of the available prediction methods, the Karman and Kozlov estimates of the Reynolds analogy factor agree best with the general level of the experimental data. It is concluded that experimental turbulent-heat-transfer data cannot in general be used to validate methods for predicting turbulent skin friction until a comprehensive definition of Reynolds analogy is available. Author

N70-15751# ARO, Inc., Arnold Air Force Station, Tenn.
ACOUSTIC MEASUREMENTS IN SUPERSONIC TRANSITIONAL BOUNDARY LAYERS Final Report, 30 Jul. - 26 Sep. 1968
S. R. Pate and M. D. Brown AEDC Oct. 1969 35 p refs
(Contract F40600-69-C-0001)
(AD-694071; AFDC-TR-69-182) Avail: CFSTI CSCL 20/4

Surface pressure fluctuations associated with transitional and turbulent boundary-layer flows on a sharp, slender cone at supersonic Mach numbers were experimentally investigated in a 40- by 40-in. supersonic wind tunnel using a flush-mounted 0.25-in.-diam microphone. The results at Mach numbers 3 and 4 demonstrate the feasibility of locating microphones onboard wind tunnel test models to measure overall pressure fluctuations and power spectral distributions in transitional and fully developed turbulent flows. Transition Reynolds numbers determined using a surface microphone are compared with two other established methods of detection. Selected boundary-layer pressure fluctuation characteristics (power spectral density and root-mean-square values) and transition profiles are presented. Methods of data acquisition and analysis are discussed. Author (TAB)

N70-15759*# Sandia Corp., Albuquerque, N.Mex.
THE HYPERSONIC FULLY VISCOUS SHOCK-LAYER PROBLEM
R. T. Davis Dec. 1968 32 p refs
(Grant NGR-47-004-006)
(NASA-CR-107704; PB-182610; SC-RR-68-840) Avail: CFSTI CSCL 01A

A method is developed for solving the governing equations for the shock layer which are obtained from the Navier-Stokes equations by retaining teams up to second-order in the inverse square root of the Reynolds number. The normal momentum equation is further simplified by using the thin shock-layer approximation. The governing equations are transformed into a form suitable for numerical solution with an implicit finite-difference technique. The method is used to obtain the flow field on a hyperboloid. Author (USGRDR)

N70-15791*# Hydronautics, Inc., Laurel, Md.
ON FLOW PAST A CASCADE OF PARTIALLY CAVITATING CAMBERED BLADES
C. C. Hsu Mar. 1969 21 p refs
(Contract NAS8-20625)
(NASA-CR-102416; TR-703-6) Avail: CFSTI CSCL 20D

The problem of the flow of incompressible, inviscid fluid past a partially cavitating cascade of cambered blades is studied. The analysis is based on the assumptions that the flow is two dimensional and that disturbances are small. With the aid of conformal transformation, it was found possible to provide a simple method for calculating such complex flow problems. Author

N70-15820# Kyushu Univ., Fukuoka (Japan).
DEVIATION OF STREAM SURFACE DUE TO BLADE THICKNESS DISTRIBUTION AT THE INDUCER OF MIXED FLOW COMPRESSORS
Yasutoshi Senoo and Norio Kunita *In its* The Rept. of Res. Inst. of Ind. Sci., Kyushu Univ., No. 48 1969 p 25 - 31 In JAPANESE; ENGLISH summary (See N70-15816 05-25)
Avail: CFSTI

Axial velocity distribution at the inducer inlet is determined first by the hub and shroud geometries and then by the distribution of load upon inducer blades. It is also influenced by the distribution of inducer blade thickness, but this influence is often overlooked in the design of inducers. In order to examine the significance of blade thickness distribution on velocity distribution, a series of numerical analysis are made on the flow in a two-dimensional channel, into which several kinds of plates are inserted successively. Front edge of the plates is sometimes perpendicular to the main flow and other times oblique. Plates have constant thickness in some cases, but in other cases the thickness of plates varies linearly from the bottom to the top of the channel. The analytical results

are compared with dye streamlines observed in the water channel, and the results obtained are in qualitative agreement. An analysis is also made for such an axisymmetric case as a flow in an inducer. Author

N70-15821# Kyushu Univ., Fukuoka (Japan).
PRESSURE DISTRIBUTION AROUND A CYLINDER WITH JET AT THE REAR END
Yasutoshi Senoo and Michiteru Yamaguchi *In its* The Rept. of Res. Inst. of Ind. Sci., Kyushu Univ., No. 48 1969 p 32-36 refs In JAPANESE; ENGLISH summary (See N70-15816 05-34)
Avail: CFSTI

When a cylinder is mounted perpendicular to a uniform flow, the pressure distribution around the cylinder is influenced by a secondary flow which comes from the end of cylinder to the space behind the cylinder. This effect may be called "the end effect." In order to examine the relationship between the pressure distribution and the secondary flow, the secondary flow was substituted with a jet from the rear end of the cylinder. The condition of the jet was changed systematically, and the following results were obtained. (1) The pressure distribution around the cylinder depends on the momentum of the jet. (2) The momentum of the jet reduces the peak negative pressure on the cylinder and the drag of the cylinder. (3) The velocity defect of the wake of the cylinder increases with the momentum of the jet. (4) The pressure distribution around a cylinder with end effect is reproduced in a two dimensional flow around a cylinder with the jet. (5) In the preceding two cases the velocity distribution of the wake is almost identical, and (6) A hypothesis is proposed for a mechanism in which the jet increases the velocity defect of the wake. Author

N70-15998# Weapons Research Establishment, Salisbury (Australia).
THE ESTIMATION OF THE DRAG OF CIRCULAR CYLINDERS AT SUBCRITICAL REYNOLDS NUMBERS AND SUBSONIC SPEEDS
K.D. Thomson Apr. 1969 14 p refs
(HSA-149) Avail: CFSTI

Experimentally determined values of the spacing and strength of the wake vortices are used in conjunction with Karaman's vortex theory to determine the vortex drag of a circular cylinder at subcritical Reynolds numbers and subsonic speeds. These results are shown to be in close agreement with drag measurements over the Mach number range 0 to 0.8. Author

N70-16011# Joint Publications Research Service, Washington, D.C.
FORMATION OF GAS BUBBLES IN SUPERSATURATED SOLUTIONS AND IN THE LIVING ORGANISM DURING DECOMPRESSION
V.P. Nikolayev *In its* Space Biol. and Med., Vol. 3, No. 5, 31 Dec. 1969 p 78-87 refs (See N70-16001 05-04)
Avail: CFSTI

Basic characteristics of gas solutions within fluids are discussed and the mechanisms of bubble formation in supersaturated solutions and in body fluids during decompression are described. The new data obtained with respect to the structure of fluids suggest a hypothesis of the origin and nature of gas nuclei in a fluid. The theory of the bubble nucleation mechanism in a living organism is discussed. Author

N70-16022# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
NON-EQUILIBRIUM FLOW FIELDS WITH CHEMICAL REACTIONS IN A SHOCK TUBE Final Technical Report Jun. 1967 - Jun. 1969
Elihu Zimet and Peter P. Wegener Arnold Air Force Station, Tenn. AEDC Oct. 1969 79 p refs
(Contract AF 40/600/-1133)
(AD-694503; AEDC-TR-69-229) Avail: CFSTI CSCL 20/4

The two chemical reactions given by $N_2O_4 + M = 2NO_2 + M = 2NO + O_2 + M$, where M represents the inert carrier gases argon or nitrogen, were studied. The experiments were carried out in a temperature controlled shock tube and a light absorption technique permitted the time dependent concentration of the species NO_2 to be determined. For shock strengths where the temperature did not exceed 400K only the first chemical reaction took place. Stronger shock waves excited both chemical reactions with temperatures up to 2100K, and for this reason, flow fields with two nonequilibrium modes could be investigated. Since the relaxation times of these two reactions were different by about three orders of magnitude, they could be experimentally uncoupled. A study of the reaction mechanisms and rate constants for both reactions was carried out. At shock strengths exciting only the first chemical reaction the complete picture of a non-equilibrium flow field with only one nonequilibrium mode could be investigated. In this situation, the shock strengths were varied from weak, fully dispersed waves to strong, partly dispersed waves. Author (TAB)

N70-16127*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
APPROXIMATE SOLUTION OF SOME NONSTATIONARY BOUNDARY-LAYER PROBLEMS WITH ALLOWANCE FOR A MAGNETIC FIELD [PRIBLIZHENNOYE RESHENIYE NEKOTORYKH NESTATSIONARNYKH ZADACH POGRANICHNOGO SLOYA S UCHETOM MAGNITNOGO POLYA]
Dzh. V. Sharikadze Washington NASA Jan. 1970 5 p refs Transl. into ENGLISH from Soobshcheniya Akad. Nauk Gruzin. SSR (Tiflis), v. 45, Jan. 1967 p 43-46
(Contract NASw-1692)
(NASA-TT-F-12832) Avail: CFSTI CSCL 20D

Discussion of the nonsteady flow of a viscous incompressible electrically conducting fluid past a flat plate, in the case where a constant external magnetic field is applied normal to the plane of the plate. The magnetic field induced in the fluid is neglected. A solution of the problem is obtained by a method proposed by Shvets for stationary problems and modified by Dobryshman for nonstationary boundary-layer problems. Author

N70-16130*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
MOTION OF A DROP OF ALKALI METAL IN A CURRENT OF VAPOR WITH CONDENSATION [O DVIZHENII KAPLI SHCHELOCHNOGO METALLA V POTOKE PARA PRI NALICHII KONDENSATSII]
G. B. Rybchinskaya et al Washington NASA Jan. 1970 6 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (Moscow), no. 4, 1968 p 801-803
(Contract NASw-1692)
(NASA-TT-F-12770) Avail: CFSTI CSCL 20D

The time dependence of the velocity of a drop of alkali metal, injected into a saturated moving vapor, is considered. A difference of 0.5% between drop velocity with and without consideration of condensation effects is found. Author

N70-16145# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.
CALCULATION OF LAMINAR TWO-PHASE BOUNDARY LAYERS WITH CORRELATION BETWEEN HEAT AND MASS TRANSFER IN THE EVAPORATION OF A LIQUID FILM ON A FLAT PLATE IMMERSED IN A PARALLEL FLOW: COMPARISON OF CALCULATION METHODS [BERECHNUNG VON LAMINAREN ZWEISTOFFGRENZSCHICHTEN MIT GEKOPPELTEM WAERME- UND STOFFUEBERGANG BEI VERDUNSTUNG EINES FLUESSIGKEITSFILMS AUF EINER PARALLEL ANGESTROEMTEN EBENEN PLATTE: VERGLEICH VON

RECHENVERFAHREN]
Hans-Wilhelm Orth Jun. 1969 54 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-33) Avail: CFSTI

For the determination of the boundary layers of a vaporizing liquid layer on a flat plate, calculations based on the concept of similar solutions were performed, using various similarity parameters. The effect of the fluid properties is significant, so the variations of the properties within the boundary layer as a function of temperature and concentration were evaluated either by the kinetic theory of gases or by simplifying assumptions and taking average values. The deviations were estimated by comparison of numerical results. The advantage of taking the average values of the properties is demonstrated by a computed diagram which can be used for shortening the calculations for the determination of the boundary layers. Author (ESRO)

N70-16186# Grenoble Univ. (France). Faculte des Sciences.
CONTRIBUTION TO THE STUDY OF THE EQUILIBRIUM LIMIT OF SOILS AND OF GRANULAR AND COHERENT MATERIALS [CONTRIBUTION A L'ETUDE DE L'EQUILIBRE LIMITE DES SOLS ET DES MATERIAUX PULVERULENTS ET COHERENTS]
Robert Negre (Ph.D. Thesis, 11 Sep. 1968) [1968] 196 p refs in FRENCH
Avail: CFSTI

The equilibrium limit of materials was studied under conditions encountered in civil engineering, with the assumption of initial flow, homogeneous and isotope materials, small deformations etc. The theory is applied to wrenching of piles, the piling of earth silos, and the theory of triaxial tests. ESRO

N70-16187# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Freiburg (West Germany). Inst. fuer Angewandte Mathematik und Mechanik.
ON NON-LINEAR THREE-DIMENSIONAL INSTABILITY OF LAMINAR BOUNDARY LAYER FLOWS [UEBER EINE NICHTLINEARE DREIDIMENSIONALE INSTABILITAET LAMINARER GRENZSCHICHTSTROEMUNGEN]
Klaus Menzel Aug. 1969 126 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-48) Avail: CFSTI

The instability of boundary layer flows with amplified plane Tollmein-Schlichting waves was investigated with respect to three-dimensional perturbations. One of the quadratic non-linear terms occurring in the perturbation series expansion represents a system of longitudinal vortices of the Taylor-Görtler type. This type of disturbance may grow before the amplification of the primary linear three-dimensional term begins. Numerical evaluation for the case of the boundary layer flow along a flat plate yielded a quantitative interpretation of the experimentally observed three-dimensional behavior of the disturbance development which could not have been obtained by the linear stability theory alone. Author (ESRO)

N70-16333# Sussex Univ., Brighton (England). School of Applied Science.
AN EXPERIMENTAL INVESTIGATION OF LAMINAR HEAT TRANSFER IN A UNIFORMLY HEATED TUBE ROTATING ABOUT A PARALLEL AXIS
W. D. Morris London HMSO 1969 20 p refs Supersedes ARC-30526
(ARC-CP-1055; ARC-30526) Copyright. Avail: HMSO 5s; BIS $1.00; CFSTI

The results of an experimental investigation which studies the influence of rotationally induced buoyancy on heat transfer in a tube which rotates about an axis parallel to itself is presented. Data obtained with water and 100% glycerol appear to confirm the qualitative description of flow given by two theoretical analyses. A reliable qualitative method of prediction is still unavailable. Author (ESRO)

N70-16358# Royal Aircraft Establishment, Farnborough (England). Aerodyanamics Dept.
SUPERSONIC LAMINAR BOUNDARY LAYERS ON CONES
J. C. Cooke London HMSO 1969 44 p refs
(ARC-CP-1063; RAE-TR-66347; ARC-28839) Avail: CFSTI Supersedes RAE-TR-66347; ARC-28839

The boundary layer flow over a cone inclined at a small angle to a supersonic stream, and over a type of caret (Maikapar, Nonweiler) surface, as generalized by Townend, is calculated by an implicit finite difference method. Prandtl number is arbitrary but viscosity must follow the Chapman -Rubesin law. Any (conical) distribution of wall temperature or heat flux can be covered; the effects of suction or blowing can only be included if the normal velocity along a ray varies inversely as distance from the apex. Some sample calculations are made. The method begins to break down as separation is approached, but it is not difficult to find the separation line by extrapolation. Author (ESRO)

N70-16359# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
FLIGHT MEASUREMENTS OF WING-TIP VORTEX MOTION NEAR THE GROUND
F. W. Dee and O. P. Nicholas London HMSO 1969 40 p refs
(ARC-CP-1065; RAE-TR-68007; ARC-30345) Copyright. Avail: HMSO 9s; BIS $1.80; CFSTI Supersedes RAE-TR-68007; ARC-30345

Tests were made to measure the movement of the wing tip vortices from a Hunger aircraft flying at 170 knots approximately 35 feet above a runway, in a variety of wind conditions. Measurements were limited to a maximum time of 20 seconds after vortex generation. During this period the theoretical predictions presented are in good general agreement with the observed motions, however significant differences did occur. There was no clear indication whether the vortices decayed more rapidly in the presence of the ground and atmospheric turbulence, than would have been expected from earlier measurements away from the ground in calm air. Limited tests were also made to study the vortex mutual interaction away from the ground. Author (ESRO)

N70-16363# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON A SOLUTION OF THE TURBULENT MIXING EQUATIONS WHEN THE TRANSFER FUNCTIONS PRESENT A SPATIAL SIMILARITY [SUR UNE SOLUTION DES EQUATIONS DU MELANGE TURBULENT DANS LE CAS OU LES FONCTIONS DE TRANSFERT PRESENTENT UNE SIMILITUDE SPATIALE]
Roland Borghi (Ph.D. Thesis--Paris Univ.) 1969 50 p refs In FRENCH; ENGLISH summary
(ONERA-NT-143) Avail: CFSTI

The so-called boundary layer equations are presented in a new way to allow the precise definition of the coefficients of mass, enthalpy and momentum turbulent transfer. Solutions in the von Mises plane, when these equations apply to the isobaric mixing of two co-axial jets, are then made possible by the definition of new parameters together with a simple similarity assumption for them in the plane, and the classical approximation Pr approximately 1. The existence of similar solutions is shown, when the initial conditions stay within a certain range; and they may be generalized when the Prandtl number is no longer close to unity, but stays constant along the axis. The method is essentially theoretical and to give practical results, needs to be confronted with several experiments. Author (ESRO)

N70-16365# Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Mecanique des Fluides.
CONTRIBUTION TO THE STUDY OF FLOW PROBLEMS IN UNSATURATED POROUS MEDIA [CONTRIBUTION A L'ETUDE DES PROBLEMES D'ECOULEMENT EN MILIEUX POREUX NON SATURES]

Georges Vachaud (Ph.D. Thesis—Grenoble Univ., 4 Oct. 1968) Grenoble Univ. [1969] 277 p refs In FRENCH; ENGLISH summary
Avail: CFSTI

The objective of this study was to examine the validity of some of the current assumptions and models used to describe the flow of water in unsaturated soils. A gamma-ray attenuation technique was used to follow water content changes in the soil under conditions of infiltration, redistribution (after infiltration) and drainage. With regard to infiltration, a method is described for determining the hydraulic conductivity function from a transient flow analysis of the water content profiles. The generalized Darcy's law, used to describe the flow of water in unsaturated soils, was found to be valid. A comparative evaluation of the effect of gravity on the flow process was also obtained from experiments on horizontal infiltration, vertical downward infiltration and capillary rise. Hysteresis effects during the redistribution process have been considered. In particular a method for obtaining the scanning curves in the water content-suction relationship by an analysis of the water content profiles during redistribution of the horizontal infiltration has been proposed. Author (ESRO)

N70-16366 New York Univ., N.Y. School of Engineering and Science.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE NEAR WAKE IN AN AXISYMMETRIC SUPERSONIC FLOW WITH AND WITHOUT BASE INJECTION
Ramlala P. Sinha (Ph.D. Thesis) 1968 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-4579

For the experimental part an extensive study of the near wake has been done with and without base injection to obtain a better understanding of the problem. Radial and axial profiles for pressure, temperature, Mach number, velocity, and concentration have been obtained at a free stream Mach number of 3.9 but with different Reynolds numbers. Two coaxial streamlined center-bodies of base diameters 1.4 inch and 0.625 inch respectively were used for this investigation. The test section diameter was 8 inches. For the theoretical part various empirical models for turbulent viscosity have beep investigated to determine which one of these predicts more closely the experimentally obtained pressure, temperature, Mach number, velocity, and concentration distributions in the flow field. On the other hand, centerline turbulent viscosity distribution in the wake has been calculated from the experimental profiles using full Navier-Stokes equations and compared with those obtained from empirical models. Dissert. Abstr.

N70-16401*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
AN ACOUSTIC INSTABILITY DRIVEN BY ABSORPTION OF RADIATION IN GASES
Michael J. Monsler (Ph.D. Thesis) Dec. 1969 147 p refs
(Grant NGL-22-009-019)
(NASA-CR-107738; CSR-T-69-4) Avail: CFSTI CSCL 20D

The stability of a steady-state radiating gas with a nonuniform temprature distribution is investigated. It is found that an instability may arise due to the absorption of radiation by the fluctuations in the gas. The instability mechanism is critically dependent on the rate of change of opacity with temperature and a sufficiently large net radiative energy flux. Two approaches have been undertaken to understand this stability problem. First, wave propagation in nonuniform radiating gases is examined and the criterion for amplification of acoustic waves traveling in the direction of the net heat flux is derived. Secondly an eigenvalue problem is solved for the complex frequencies of the natural oscillations of a nonuniform radiating gas, for the boundary conditions of black walls of constant temperature. Critical values of the net radiative heat flux for neutral stability are calculated as a function of the other parameters. It is found that the lower normal modes of oscillation are most unstable and that the gas must be optically thick for the instability to occur. The instability can occur only if the opacity increases at least as the fourth power of the temperature. Author

N70-16471 Oregon State Univ., Corvallis.
BOUNDARY LAYER TRANSITION
Vidya Sagar Bakhshi (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-5821

This work is devoted to the study of laminar boundary layer transition. In this case, transition from the region near the surface of the body to the main stream takes place within a thin layer called the boundary layer. Although the basic properties of the fluid remain the same its behavior changes appreciably from the surface of the body to the main stream. Owing to the presence of spin, rotation or vorticity effects, the transition phenomenon is nonlinear, irreversible and non-conservative and hence it cannot be treated satisfactorily by superposition or perturbation techniques. An attempt is made to study the transition as an asymptotic phenomenon from the boundary layer. The transition concept is also extended to magnetohydrodynamics. Aformula for the magnetohydrodynamic boundary layer thickness is obtained in terms of two parameters on the basis of a magnitude analysis. The transition equation for two dimensional magnetohydrodynamic case is also obtained Dissert. Abstr.

N70-16473 University of Southern Calif., Los Angeles.
AN ANALYSIS OF STEADY TWO-DIMENSIONAL AND INCOMPRESSIBLE TURBULENT BOUNDARY LAYERS
Abraham C. Peter (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-4539

Analytical methods leading to the prediction of turbulent boundary layer friction effects in flows for which the velocity defect similarity rule as well as the law of the wall hold true are investigated. A compatibility condition of the energy integral equation within the defect law similarity hypothesis is utilized in a consistent formulation of similarity requirements, for which necessary and sufficient conditions are defined. A direct application of the law of the wall principle allows the representation of the pressure gradient in terms of similarity variables, without recourse to extraneous similar parameters, which are shown to place a constraint upon the form of the turbulent shearing stress. An analytical method allowing a direct extension of the present analysis to the derivation of the differential equation of turbulent boundary layer by means of the energy integral and the sufficiency requirement for similar flows is also discussed. Dissert. Abstr.

N70-16594# Akademiya Nauk URSR, Kiev.
CALCULATING THE EFFECT OF HEAT TRANSFER ON AIR DISTRIBUTION IN A MINING NETWORK
B. I. Medvedev (Donets Politechnical Inst.) *In its* Mining Thermophysics 1968 p 66–72 In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

When solving problems of air movement in mines and its distribution in the ventilation network, the effect of heat transfer is usually ignored and the initial parameter is assumed to be the equality of depressions along different flows between any two junctions of the ventilation network, i.e. between the initial and final points of each flow, the thermodynamic processes of the change of state of the air are assumed to be identical. However, when designing the ventilation network of deep shafts and ventilation modes in the case of fires, this assumption can lead to large errors. It is more correct to assume that two values of static air pressure may not exist simultaneously at the same point in the ventilation network during steady parallel-flow motion, and that the algebraic sum of mass air consumption is equal at all junctions of the network. Transl. by R.B.

N70-16651 Tulane Univ., New Orleans, La.
NUMERICAL SOLUTION FOR FLUX COMPONENTS IN POTENTIAL FLOW
William Joseph Gates (Ph.D. Thesis) 1968 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-3796

Values of the flux components are often desired in potential flow problems. The previous numerical solution procedures for these problems, principally the alternating-direction implicit method, involve solving Laplace's equation for the potential and then numerically differentiating the potential to obtain the flux components. The continuity equation and the irrotationality condition form a coupled system of first order hyperbolic partial differential equations that define the flux components for the two-dimensional case. These have recently been solved by the centered difference method. A new second-order correct finite differencing technique is developed for solving these equations. The two types of equations are written on different rows of points on the finite difference grid so that the values of the two flux components to be determined form a checkerboard pattern on the grid. Dissert. Abstr.

N70-16652 Texas A&M Univ., College Station.
A STUDY OF THE SPEED OF PROPAGATION OF SMALL AMPLITUDE PRESSURE PULSES IN A TWO-PHASE, TWO-COMPONENT MIXTURE WITH AN ANNULAR FLOW PATTERN
Clarence William Garrard, Jr. (Ph.D. Thesis) 1968 81 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-5127

In a single-phase fluid the critical flow rate is determined by the speed of sound in the fluid, i.e., the speed at which a pressure wave of infinitesimal amplitude is propagated through the single-phase system. Since this fact has been experimentally verified for single-phase gases, a logical approach is to assume that a similar situation exists in two-phase systems. This approach has led to a comparison of measured critical flow rates to pulse propagation speeds in two-phase systems. Although trend-wise agreement has been found for bubbly two-phase systems, significant differences in the magnitude exist. To obtain a better understanding of the relationship between critical flow rates and pulse propagation speeds in two-phase systems, an experimental study was performed on the propagation of pressure pulses in a water-air system with an annular flow pattern. Dissert. Abstr.

N70-16656 Michigan State Univ., East Lansing.
CONSTITUTIVE EQUATIONS AND THE SOLUTION OF SOME PROBLEMS OF INTERACTING CONTINUOUS MEDIA
Farhad Tabaddor (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-5969

A mathematical statement describing the incompressibility condition for a mixture of n incompressible Newtonian fluids and a linear elastic solid was obtained. Using a thermodynamic theory of interacting media, the constitutive equations are derived for a binary mixture of an incompressible Newtonian fluid and a linear elastic solid. The similarities between these governing equations and those for a binary mixture of a compressible fluid and a linear elastic solid are discussed. A system of field equations are formulated and the general solution for the displacements are presented for the steady-state case. A stress function solution for partial stresses of the solid was developed for steady-state plain-strain problems. These methods were applied to solve a two-dimensional problem. The reduction of the present theory to Biot's consolidation theory and Darcy's law of fluid flow through porous media is discussed. Dissert. Abstr.

N70-16680 Ohio State Univ., Columbus.
THE KAPITZA EFFECT IN THE LIQUID AND VAPOR PHASES OF HE-3 AND HE-4
Samuel Prentiss Sawyer (Ph.D. Thesis) 1968 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-4963

The thermal boundary resistance at a copper surface in several low temperature fluids has been measured between 1.5 K and 4.5 K by using a copper guard ring conductance cell with a plate separation of less than 7 microns. In gaseous He3 and He4 a boundary resistance independent of pressure can be distinguished from the pressure dependent resistance expected from kinetic theory. Measurements in the gases extended over the pressure range from .01 mm. Hg. (where the gas kinetic effect becomes dominant) to the saturated vapor pressure. Dissert. Abstr.

N70-16690 Ohio State Univ., Columbus.
AN ANALYTICAL STUDY OF A FLUID CYLINDER MODEL OF AN ELECTRIC ARC BALANCED BY MUTUALLY PERPENDICULAR MAGNETIC AND FLOW FIELDS
Deane Hajime Kihara (Ph.D. Thesis) 1968 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-4918

An electric arc balanced by a magnetic field against a transverse stream is represented by an impermeable fluid cylinder model. This model allows for (1) the exchange of momentum by shear stresses and (2)energy exchange by conductive heat transfer around the cylindrical surface. Convective effects through the surface are assumed not to occur. The fluid dynamic and heat transfer characteristics within and without the fluid cylinder model are investigated by proper matching of both flow and temperature fields at the cylinder boundary. This study shows that the arc radius and centerline temperature can be calculated provided the magnitudes of the applied external fields, the electric field, the magnetic field, and the cross-flow field, are known. The relationships among these parameters for a nitrogen arc is shown graphically. Dissert. Abstr.

N70-16739# Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
COMPARATIVE STUDIES OF DROP IMPINGEMENT EROSION AND CAVITATION EROSION Final Report, Oct. 1965 - Apr. 1969
John F. Ripken Apr. 1969 45 p refs
(Contract Nonr-710-(72))
(AD-694917; Rept-105) Avail: CFSTI CSCL 20/4

It has been theorized that the fundamental mechanism of cavitation erosion was essentially the same as that of impingement erosion. The tests conducted in the study were intended to provide additional cavitation and impingement data to support this theory. The tests were conducted on three materials supplied for round-robin cavitation test program. Complete cavitation tests and limited impingement tests on the three materials are described together with test data on two other metals. Further descriptive material on details for impingement testing is also included. Only a limited comparison of cavitation and impingement erosion was possible with the data available. This suggests that accelerated laboratory erosion tests may, in fact, over-accelerate the erosion to such an extent that it is not possible to tie the observed erosion to the prototype problem. Author (TAB)

N70-16761 Missouri Univ., Columbia.
DETERMINATION OF ROTATIONAL RELAXATION TIMES OF MOLECULES FROM THERMAL TRANSPIRATION MEASUREMENTS
Robert Nelson Healy (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-3389

The formal kinetic theory was used to derive explicit expressions for the heat of polyatomic gases. The terms involving inelastic collisions which contribute to the heat conductivity are

irreducible but are the expressions for the relaxation times of the internal molecular modes. Assuming that the rotational relaxation time is much less than the relaxation times for the other internal modes, the kinetic theory expression for heat conductivity of a polyatomic gas may be written in terms of the rotational relaxation time of the molecule. Rotational relaxation times were obtained for nitrogen, oxygen, hydrogen, carbon dioxide, methane, water vapor and tetrafluoromethane over a temperature range from 93 C to 171 C. Dissert. Abstr.

N70-16764 Ohio State Univ., Columbus.
A THEORETICAL ANALYSIS OF TURBULENT SHEAR FLOWS
George David Huffman (Ph.D. Thesis) 1968 363 p
Avail: Univ. Microfilms: HC $16.45/Microfilm $4.65 Order No. 69-4905

The equations describing turbulent shear flows are obtained from their laminar flow counterparts by first decomposing the flow parameters into a mean and fluctuating component and then averaging the resulting relations. The application of this process results in the appearance of the turbulent transport terms, e.g., the Reynolds stresses, in the equations of motion. A system of equations describing the Reynolds stresses and their contracted counterpart – the turbulent energy – is obtained from the dynamical equations. The momentum and turbulent energy equations can be brought into a solvable form by analyzing the turbulent transport and dissipative processes. The turbulent transport process is assumed to consist of both a gradient-type diffusion transfer and a convective exchange. The use of a gradient-type diffusion transport necessitates the definition of a turbulent exchange coefficient. Two different mathematical models are employed in the description of this coefficient. Dissert. Abstr.

N70-16805# Institut Franco-Allemand de Recherches, St. Louis (France).
PROPAGATION OF SHOCK WAVES IN GALLERIES. EXPERIMENTS IN A SHOCK TUBE [PROPAGATION DES SOUFFLES EN GALERIE. EXPERIMENTATION DANS UN TUBE A CHOC]
L. Bobin, C. Thery, M. Pfister, and D. Laxer 22 Jul. 1969 49 p refs In FRENCH; GERMAN summary
(Contract DTEn-69.70.152.00.480.92.92)
(ISL-T-29/69) Avail: CFSTI

Conical chambers are used to simulate medium strong shock waves in a shock tube of 200 mm diameter and to investigate their expansion in an overall length of 105 caliber. Experimental results are compared with Clark's theory in order to verify his assumption of viscous damping. It is concluded that the proposed limits are valid for the chosen wave strength and the geometry of the used shock tunnel. Transl. by G.G.

N70-16806# Brussels Univ. (Belgium). Inst. of Applied Mechanics.
MAGNETOHYDRODYNAMIC FLOW STUDIES OF INCOMPRESSIBLE FLUIDS IN PIPING [CONTRIBUTIONS A LA CONNAISSANCE DES ECOULEMENTS MAGNETOHYDRODYNAMIQUES DE FLUIDES INCOMPRESSIBLES EN CONDUITE]
Andre Jaumotte et Charles Hirsch 1969 73 p refs In FRENCH
(Rept-23) Avail: CFSTI

Magnetohydrodynamic flow equations are derived for real incompressible fluids in cylindrical pipes with triangular and square walls. Solutions are given for flows in which the magnetic fields are parallel and perpendicular to the side of the equilateral triangle. Magnetic and induction fields are measured from various inclines. A description of the pipes with and without an exterior circuit is also given. Graphical representations depict the variations in the charge function. Transl. by J.M.C.

N70-16839 Ohio State Univ., Columbus.
BOUNDARY LAYER SEPARATION CONTROL AND WALL TEMPERATURE CONTROL BY TANGENTIAL FLUID INJECTION
George William Haering (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-4899

Gas film cooling advantages over other mass transfer cooling systems are assessed. Three aspects of the film cooling process were experimentally studied. Due to equipment limitations the actual experiments represent a less stringent problem than a hypersonic engine. Experimental data were taken at a mainstream velocity of about 120 feet per second and a secondary flow of fluid was injected tangentially through a slot along a wall at comparable velocities. The mainstream flowed against an adverse pressure gradient. Both fluids were air at moderate temperatures. The aspects studied were: (1) The effects of an adverse pressure gradient on the effectiveness of film cooling, (2) The effects of the geometry of the coolant injector on effectiveness. (3) The ability of a film cooling system to impede boundary layer separation in an adverse pressure gradient. Dissert. Abstr.

N70-16860# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
THE ROCHE COORDINATES IN THREE DIMENSIONS AND THEIR APPLICATION TO HYDRODYNAMICS
Zdenek Kopal Sep. 1969 34 p refs *Its* Math. Note-616
(AD-694496; DI-82-0894) Avail: CFSTI CSCL 20/4

In a preceding report (AD-688 245), a new system of curvilinear coordinates–hereafter referred to as Roche coordinates was introduced–in which spheres of constant radius are replaced by equipotential surfaces of a rotating gravitational dipole, while the remaining angular coordinates are made orthogonal to the equipotentials. In the previous report the explicit form of such coordinates was derived, and their relationship was established with polar coordinates (with which they coalesce in the immediate neighborhood of each one of the two mass points) in the plane case. The aim of the present report will be to generalize the definition of the Roche coordinates to three dimensions. A formulation of the fundamental equations of hydrodynamics is given in terms of three-dimensional Roche coordinates and their advantages for treatment of certain classes of dynamical problems are illustrated. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-15512# Technische Hochschule Munchen (West Germany).
ON THE BEHAVIOR OF ARTIFICIAL CLOUDS IN THE IONOSPHERE AND MAGNETOSPHERE [UEBER DAS VERHALTEN KUENSTLICHER IONENWOLKEN IN IONOSPHAERE UND MAGNETOSPHAERE]
Manfred Scholer (Ph.D. Thesis) 2 Jul. 1969 120 p refs In GERMAN
Avail: CFSTI

Artificial ionic clouds in the magnetosphere were produced by solar untroviolet ionization of a rocket deposited copper oxide-barium mixture. Interactions of the ion cloud with the earth's magnetic field, electric fields, and magnetospheric materials depended on the height of the cloud. Neutral particle density in the ionosphere up to 400 km brought expansion of the barium cloud to an equilibrium after a short time so that further motion was governed by a diffusion process underlying sedimentation caused by earth velocity. Ion cloud motion analysis relative to the

magnetospheric plasma showed that the interaction of a cloud-transversing flow channel determined the braking effect in the ionosphere; the ion cloud was coupled to the background plasma by the magnetic field. Transl. by G.G.

N70-15517# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
RC-135A/USQ-28 CATEGORY 2 TEST: EVALUATION OF THE EXPONENTIAL METHOD TO DETERMINE IOR PROFILES Technical Report, Jul. - Oct. 1968
Robert E. Dean Sep. 1969 101 p
(AD-695474; ASD-TR-69-87) Avail: CFSTI CSCL 8/5

An IOR computer program was written to determine the true velocity and IOR profiles utilizing temperature, pressure, and humidity data acquired from three sources; namely, the SHIRAN ground equipment, the radiosonde, and the SHIRAN airborne equipment. An alternate IOR computer program was written that would not utilize radiosonde data. Using data that were collected during the AN/USQ-28 Category II flight tests, both computer programs were run to the point where the corrected slant ranges of the D. two methods could be compared. TAB

N70-15537# Technishe Hochschule Munchen (West Germany).
HYDROGEOLOGY AND HYDROCHEMISTRY OF SOUTH RHOEN WITH SPECIAL CONSIDERATION OF MINERAL SPRINGS IN THE VICINITY OF BRUECKENAU [HYDROGEOLOGIE UND HYDROCHEMIE DER SUEDRHOEN UNTER BESONDER BERUECKSICHTINGUNG DER MINERALQUELLEN IM BRUECKENAUER RAUM]
Peter Udluft (Ph. D. Thesis) 2 Jul. 1969 224 p refs In GERMAN
Avail: CFSTI

Presented is a comprehensive hydrogeological and hydrochemical survey for a mountainous region in Southern Germany with emphasis on the mineral characteristics of its natural waters and underground springs. Proposed is the erection of a protective zone against deep drilling in order to prevent quantitative and qualitative changes in the therapeutic composition and water qualities of the health resort Brueckenau. A 10 meter radius is found efficient for protecting the interest of the health resort against carbon dioxide degassing and lowering of underground water level. Transl. by G.G.

N70-15550# Massachusetts Univ., Amherst. Coastal Research Group.
HOLOCENE SEDIMENTS OF THE PARKER RIVER ESTUARY, MASSACHUSETTS
Joan M. Da Boll Jun. 1969 150 p refs /ts Contrib. No. 3-CRG
(Contract N00014-67-A-0230)
(AD-694493) Avail: CFSTI CSCL 8/7

The primary goals of this study are to present a detailed description of the sediments of the Parker River estuary and to provide data on the dynamics of intertidal environments. The project is part of a larger comparative study of selected New England estuaries with different hydrographic patterns and sediment sources. Author (TAB)

N70-15581*# IIT Research Inst., Chicago, Ill.
ATMOSPHERIC DESIGN CONCEPTS FOR CROSS-BEAM EXPERIMENTS Final Report
R. D. Sears Apr. 1969 73 p refs
(Contract NAS8-20107)
(NASA-CR-102413; IITRI-J6096) Avail: CFSTI CSCL 04A

The feasibility of application of the cross beam remote sensing technique to problems of atmospheric research was investigated. The classes of problems treated include the study of tropospheric sources of probing signal such as scattered sunlight, the modulation of a remote probing signal by extinction fluctuations, the characteristics of atmospheric density fluctuations at high altitudes, the characteristics of nonthermal emission from the upper atmosphere, and treatment of the problem of the photochemistry of allotropes of oxygen as applied to remote determination of atomic oxygen density by the cross beam remote sensing method. It was analytically shown that scattered sunlight and extinction fluctuations in the troposphere may be treated as a remote probing signal for cross beam measurements. The connection between the experimentally determined two beam intensity fluctuation product and the density profiles of excited species in the upper atmosphere was illustrated by the solution of the atomic oxygen density profile problem. Author

N70-15623# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LONG-PERIOD SIGNAL PROCESSING RESULTS FOR THE LARGE APERTURE SEISMIC ARRAY
Jack Capon, Roy J. Greenfield, and Richard T. Lacoss 17 Jan. 1969 27 p refs Revised
(Contract AF 19(628)-5167; ARPA Order 512)
(AD-694326; JA-3193; ESD-TR-69-221) Avail: CFSTI CSCL 17/10

The results of a series of off-line signal processing experiments are presented for long-period data obtained from the Large Aperture Seismic Array (LASA) located in eastern Montana. The signal-to-noise ratio gains obtained with maximum-likelihood processing, as well as other simpler forms of processing, are presented for body-waves as well as surface-wave phases. The matched filtering of surface waves using chirp waveforms is shown to be highly effective. A useful discriminant for distinguishing between natural seismic events and underground nuclear explosions, using both the long-period and short-period data, was found to be the relationship between the surface-wave and body-wave magnitudes. Measurements of this discriminant made on events from four tectonic regions of the earth are presented. Author (TAB)

N70-15687*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A MODEL ATMOSPHERE FOR EARTH RESOURCES APPLICATIONS
David E. Pitts and Kirby D. Kyle Nov. 1969 49 p refs
(NASA-TM-X-58033) Avail: CFSTI CSCL 04A

A computer subprogram set is described which permits the use of radiosonde data to provide model atmosphere data for earth resources applications. All earth resources remote-sensing techniques are affected by the atmosphere lying between the target and the sensor. The computer program presented in this report offers a method of numerical use of radiosonde data so that atmospheric effects may be assessed and possibly removed from the signal. Author

N70-15703# Ohio State Univ., Columbus. Dept. of Geodetic Science.
A GENERAL THEORY OF GRAVITY PROCESSING Scientific Report
Helmut Moritz May 1969 66 p
(Contract F19628-69-C-0127)
(AD-694112; OGS-122; AFCRL-69-0258; SR-1) Avail: CFSTI CSCL 8/5

A unified least-squares method permits the estimation of the gravity anomaly field from discrete (terrestrial gravity measurements) or continuous (aerial gravity profiles) data affected by random errors of measurement. This method serves both for predicting the gravity anomaly at points where there are no measurements, and for filtering the data for these random errors. It comprises the usual prediction from errorless data as a special case. The general case of inaccurate data may be reduced to this special case by applying a preparatory least-squares filtering to the data. Details are worked out both for point and profile measurements. The case of n parallel gravity profiles is

mathematically reduced to the case of gravity measurements at n points by applying a Fourier transform. Along-track, across-track, and combined filtering of aerial gravity measurements and their use for estimating the gravity anomaly field are studied. A method for eliminating systematic errors is given. Author (TAB)

N70-15732# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ESTIMATION OF SEISMICITY AND NETWORK DETECTION CAPABILITY
Edward J. Kelly and Richard T. Lacoss 16 Sep. 1969 44 p refs
(Contract AF 19(628)-5167; ARPA Order 512)
(AD-695044; ESD-TN-69-250; TN-1969-41) Avail: CFSTI CSCL 8/11

The problem of estimating seismicity and the performance of a system which detects earthquakes is formulated in such a way that maximum likelihood estimation can be applied. The mean number of earthquakes which occur in a fixed time interval is assumed to be of the form exp (a-bm) where m is magnitude and a and b are constants. The probability of detection as a function of m is taken to be an error function. Procedures to obtain maximum likelihood estimates of a, b, and the error function mean and variance factors are derived, discussed, and applied to experimental data to check the relevance of the theoretical development. Author (TAB)

N70-15741# Lockheed Missiles and Space Co., Sunnyvale, Calif. Ocean Lab.
A COMPARISON OF THE TEST RESULTS OF VANE AND DIRECT SHEAR TESTS MADE ON RECENT MARINE SEDIMENTS
A. L. Inderbitzen and F. Simpson Nov. 1969 25 p refs
(LMSC-694965) Avail: CFSTI

Shear strength envelopes calculated from consolidated undrained direct shear tests were compared to strength envelopes calculated from vane shear tests made throughout the length of a sediment core. These comparisons were made on shear strength measurements from seven recent marine sediment cores. The seven sediment cores used for this study were obtained from the upper San Diego Trough slope in water depths of 249 to 291 meters. The materials tested were classified primarily in the clayey silt to silty clay range based upon grain size distribution. According to the measured activity ratios the predominant constituent of the clay size fraction appears to be mica. Author

N70-15750# Lamont Geological Observatory, Palisades, N.Y.
RESEARCH DIRECTED TOWARD THE USE OF LONG AND INTERMEDIATE PERIOD SEISMIC WAVES FOR THE IDENTIFICATION OF SEISMIC SOURCES Annual Technical Report, 1 Aug. 1968 - 1 Aug. 1969
Frank J. Gumper Aug. 1969 33 p
(Contract F19628-68-C-0341)
(AD-695495; AFCRL-69-0407; ATR-1) Avail: CFSTI CSCL17/10

Seismological research supported by Air Force contract F19(628)-68-C-0341 at the Lamont-Doherty Geological Observatory is summarized for the period 1 August 1968 to 1 August 1969. During this period significant advances haave been made toward the use of long and intermediate period seismic waves for the identification of seismic sources. Our increased understanding of many features of the seismogram has enhanced its utility in detecting and identifying small seismic events. A large network of long and intermediate period instruments has been operated, and new high sensitivity, broad-band, low noise instruments have been developed which have proved especially effective for detecting and discriminating small events. Studies of seismicity and focal mechanisms for several tectonic regions and the attenuation of the Sn phase have provided additional support for the model of the New Global Tectonics. Study of the relative excitation of both body waves and surface waves by earthquakes and explosions have continued to reveal it to be a powerful discriminant between the two sources. The steady development of computer programs has permitted rapid and sophisticated analysis of both conventional and Large Aperture Seismic Array data. Thus, important progress has been made toward detecting and identifying seismic events. Author (TAB)

N70-15752# Purdue Univ., Lafayette, Ind. Lab. for Agricultural Remote Sensing.
AGRICULTURAL APPLICATIONS AND REQUIREMENTS PROGRAMS Quarterly Progress Report 1 Jan. - 31 Mar. 1969
31 Mar. 1969 38 p
(QPR-2) Avail: CFSTI

Agricultural applications and requirements for remote sensing of environmental resources are summarized. A proposal is discussed for a prototype data system to provide information and consultation to farmers, governmental agencies, and agribusiness. Research, pilot utilization, and educational programs are reviewed. Goals are to take present data acquisition ad processing technology by remote sensing to a point adequate to accept planned earth resources satellite data, and to provide for a pilot data distribution and user educational system. Biophysical research, physical measurements, and data processing program work is reviewed. Remote sensing technology applications are described for: (1) pattern recognition programs for nonagricultural wildland resources, (2) crops classification mapping, and (3) flight analysis of crop areas C-3 and C-4. J.A.M.

N70-15762# Lockheed Missiles and Space Co., Sunnyvale, Calif. Lockheed Ocean Lab.
A MARINE GEOTECHNIQUE STUDY UTILIZING A SUBMERSIBLE. THE GEOMECHANICAL STUDY OF THE SEA FLOOR INDEPENDENT RESEARCH PROGRAM Progress Report, Nov. 1969
A. L. Inderbitzen and F. Simpson Nov. 1969 48 p refs
(LMSC-694963) Avail: CFSTI

A brief bathymetric survey was performed and seven cores obtained along two precise sampling transects by the submersible DR/V DEEP QUEST. This work was performed along a gullied section of the upper San Diego Trough slope off Del Mar, California. Purpose of the study was to investigate the topographical effects on mass physical properties of marine sediments as well as gain more information concerning the stability of underwater slopes and lateral variability of sediment properties. The cores were obtained along transects across a gully at right angles to the axis and down an interfluvial slope approximately parallel to the gully axis. Sediments within the cores were tested for shear strenth, water content, bulk density, grain size distribution and Atterberg limits. Related parameters were computed from the test results. Author

N70-15770# National Research Council of Canada, Ottawa (Ontario).
METHODS OF DETERMINING CREEP, LONG-TERM STRENGTH AND COMPRESSIBILITY CHARACTERISTICS OF FROZEN SOILS [METODIKA OPREDELENIYA KHARAKTERISTIK POLZUCHESTI, DLITEL'NOI PROCHNOSTI I SZHIMAEMOSTI MERZLYKH GRUNTOV]
S. S. Vyalov et al. Jun. 1969 110 p refs Transl. into ENGLISH of the book 'Metodika Opredeleniya Kharakteristik Polzuchesti, Dlitel'noi Prochnosti i Szhimaemosti Merzlykh Gruntov' Moscow, Nauka, 1966
(NRC-TT-1364) Avail: CFSTI

A unified method of determining the long-term strength, creep and compressibility of frozen soils is proposed. Fudamentals of frozen soil rheology, methods of testing frozen soils for long-term strength, creep and compressibility, also practical methods of processing test data and definitions of properties required in the calculation of frozen soils in terms of limiting states are examined. Author

N70-15834# Sandia Corp., Albuquerque, N. Mex.
POPULATION DISTRIBUTION ANALYSIS OF THE WORLD
V. E. Blake Jul. 1969 14 p Sponsored by AEC
(SC-RR-69-368) Avail: CFSTI

An analysis of the population distribution of the world and of the band between 35 S and 35 N latitudes is presented. Author (NSA)

N70-15849# Army Engineer Topographic Labs., Fort Belvoir, Va.
RACOMS OPERATIONS MODULE Engineer Design Test Report, 5 Jun. 1968 - 31 Jan. 1969
Francis P. Vena Jun. 1969 23 p
(AD-694351; TR-44-TR) Avail: CFSTI CSCL 8/2

Report covers the results of the Engineer Design Test for the Rapid Combat Mapping System (RACOMS) Operations Module. This module is a critical component of the RACOMS since it serves as the command control center for the entire system. Report concludes: (a) The module is suitable for effective control of system activities; (b) personnel highly experienced in mapping are required for operating this module; (c) special training of personnel is needed only for the operation of the electronic calculator; (d) no improvements of future models of this module are necessary. Author (TAB)

N70-15873# Defense Documentation Center, Alexandria, Va.
IGNEOUS ROCKS, VOLUME 1 Report Bibliography, Mar. 1962 - May 1969
Sep. 1969 179 p refs
(AD-693800; DDC-TAS-69-59-1-Vol-1) Avail: CFSTI CSCL 8/7

The objective of the work reported herein was to obtain references on studies pertaining to Igneous Rocks, which are of volcanic origin and may be found on the surface of the moon. Corporate Author/Monitoring Agency, Subject, Personal Author, Contract and Report Number indexes are included. Author (TAB)

N70-15881# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
ATTENUATION OF THE 5-mm WAVELENGTH BAND IN A VARIABLE ATMOSPHERE Research Report, 1 Oct. 1968 - 1 Mar. 1969
E. E. Reber, R. L. Mitchell, and C. J. Carter 31 Jul. 1969 61 p refs Revised
(Contract F04701-69-C-0066)
(AD-694510; TR-0066(5230-46)-1; SAMSO-TR-69-278) Avail: CFSTI CSCL 20/14

Effects of atmospheric changes on attenuation in the atmosphere are examined for the 5-mm-wavelength region of the electromagnetic spectrum (48 to 72 GHz). Attenuation versus frequency and altitude for vertical transmission through the atmosphere, caused by oxygen absorption, are tabulated for geographical and seasonal model atmospheres. The attenuation effects of atmospheric water formations are discussed and compared to oxygen attenuation. Author (TAB)

N70-15894 World Meteorological Organization, Geneva (Switzerland). Commission for Hydrometeorology.
ESTIMATION OF MAXIMUM FLOODS
1969 296 p refs *Its* Tech. Note No. 98
(WMO-233-TP-126) Copyright. Avail: Issuing Activity

The aim of this technical note is to supply the reader with information on methodsof evaluation of meteorological conditions for estimation of maximum floods. The extremes of rainfall and snow melt are estimated on the basis of physical analysis, and converted into estimates of extreme flood flows. The statistical methods and their application to storm and flood events are discussed, and the background on statistical analysis and some techniques used in variouscountries in flood frequency analysis are outlined. Finally, the use of meteorological data in estimating flood frequencies is described. Author (ESRO)

N70-15979# Air Force Cambridge Research Labs., Bedford, Mass.
MEASUREMENT AND INTERPRETATION OF POWER SPECTRUMS OF IONOSPHERIC SCINTILLATION AT A SUB-AURORAL LOCATION
Terence J. Elkins and Michael D. Papagiannis 22 Apr. 1969 13 p refs Prepared in cooperation with Boston Univ.
(AD-695546; AFCRL-69-0432) Avail: CFSTI CSCL 4/1

A study of the power density spectrum of ionospheric scintillation of a radio star and satellites, at a subauroral location, has revealed the following: (1) Scintillations generally display a pink noise spectrum, with almost uniform spectral density at frequencies below approximately 0.01 Hz, and decreasing spectral density at frequencies above this value. (2) At frequencies f>0.01 Hz, the power spectrum varies as f to the minus n, with n being typically 2.7 (i.e., a decrease of 8 db per octave). (3) The width of the spectrum displays a diurnal variation such that, on the average, higher scintillation frequencies are observed at night than during the day. It is noted that the spectrum of geomagnetic micropulsations is in substantial agreement with the scintillation power spectrum, and, therefore, a theory is developed tying the two phenomena together. A model is proposed in which horizontally ducted hydromagnetic waves produce irregularities in the F region and geomagnetic micropulsations, causing both to have the same power law spectrum. Author (TAB)

N70-16023# Naval Oceanographic Office, Washington, D.C.
EVALUATION OF THE EFFECT OF INDIVIDUAL PARAMETERS ON THE CALCULATIONS OF CURRENTS WITH THE LINEAR THEORY OF THE BAROCLINIC LAYER OF THE OCEAN [OTSENKA VLIYANIYA OTDELNYKH PARAMETROV NA RASCHETY TECHNEII PO LINEINOI TEORII BAROKLINNOGO SLOYA OKEANA]
G. Ya. Shkudnova 1969 18 p refs Transl. into ENGLISH from Gos. Okeanograficheskiy Insti. USSR v. 79 p 106 - 116
(AD-695300; Trans-443) Avail: CFSTI CSCL 8/3

The effects of individual parameters, such as water stratification and its areal variation in deep water, advection, seasonal variation with respect to the boundary conditions, etc., on the calculation of currents by the use of the linear theory of baroclinic water layer of the ocean are evaluated. Author (TAB)

N70-16025# Woods Hole Oceanographic Institution, Mass.
INFLUENCE OF CONTINENTAL DRIFT ON THE DISTRIBUTION OF TERTIARY BENTHONIC FORAMINIFERA IN THE CARIBBEAN AND MEDITERRANEAN REGIONS
W. A. Berggren and J. D. Phillips Aug. 1969 104 p refs
(Contracts Nonr-4029(00); N00014-66-C-0241)
(AD-694945; WHOI-REF-69-62) Avail: CFSTI CSCL 8/1

A marked degree of similarity exists between the benthonic foraminiferal faunas of the Mediterranean and Caribbean regions from the Paleocene-Early Miocene. The stratigraphic ranges and geographic distribution of several groups of benthonic foraminifera are discussed. Author (TAB)

N70-16039# Woods Hole Oceanographic Institution, Mass.
THE SEARCH FOR TOPOGRAPHIC ROSSBY WAVES IN THE GAPPY CURRENT RECORDS AT SITE D
Rory Thompson Aug. 1969 83 p refs
(Contract N00014-66-C-0241)
(AD-694018; WHOI-REF-69-67) Avail: CFSTI CSCL 8/3

Evidence for the existence of equivalent-barotropic topographic (Rossby) waves is found in current records from instruments moored near depths of 500, 1000, and 2000 m at Site D (39 degrees 20 minutes N, 70 degrees W). Spectra are found from the very gappy records by a new form of complex demodulation, allowing examination of periods up to 100 days. The autospectra level off at the lowest frequencies, no longer increasing as a power law. Significant coherencies of 0.6 and up between the levels and between the U and v components at each level are common. The

different levels are nearly in phase, giving significant negative correlation and momentum flux. The records taken near 100 m show few of these results, suggesting a different regime. The interpretation given to the observations is of quasi-barotropic topographic waves generated in the decay region of the Gulf Stream, being filtered by the shelf so the group velocity is nearly straight up the slope for the frequencies examined (periods of 15 to 100 days), and being absorbed by the continental shelf and upper slope. This interpretation is supported by a numeric model. Author (TAB)

N70-16040 National Lending Library for Science and Technology, Boston Spa (England).
A DANGEROUS DISEASE OF THE LANDSCAPE SPHERE
F. Ja. Shipunov 20 Jul. 1969 29 p Transl. into ENGLISH from Priroda (Moscow), no. 10, 1968 p 3–14
(NLL-M-7791-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

The productivity of land in relation to the developing anthroposphere and human activity is discussed. The productivity of dry land is compared to that of ocean bottoms with emphasis on the efficiency of photosynthesis. The threat of destroying biological resources is discussed in terms of technological constructions and urbanization which result in air pollution, water contamination, and excessive amounts of artificial radiation. It is suggested that the solution to this problem lies in the regulation of population and in the increased efficiency of photosynthesis. J.M.C.

N70-16049# Woods Hole Oceanographic Institution, Mass.
GRAVITY DATA OBTAINED DURING CHAIN CRUISE 73
Carl Bowin and Thomas C. Aldrich Mar. 1969 43 p refs
(Contract Nonr-4029(00); Grant NSF GA-976)
(AD-693971; WHOI-REF-69-15) Avail: CFSTI CSCL 8/5

Profiles, tabulations, and charts are presented of principal gravity facts, free-air gravity anomalies, and simple Bouguer gravity anomalies obtained in the western North Atlantic Ocean during R/V CHAIN Cruise 73. Author (TAB)

N70-16073 National Lending Library for Science and Technology, Boston Spa (England).
STATISTICAL SURVEY OF WAVE OBSERVATIONS
Rene Mayencon 10 Sep. 1969 15 p Transl. into ENGLISH from Cahiers Oceanogr. (Paris), no. 5, May 1969
(NLL-Trans-T-6442-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

Characteristics of waves and swells estimated visually from ships are discussed. Exponential expressions are given for the relation between height and number and for the number of wave heights equal to or surpassing a given value. The probable height of the greatest wave at one point within one, ten, or one hundred years is also determined. N.E.N.

N70-16081# Catholic Univ., Santiago (Chile). Inst. of Astrophysics.
SOME DISCOVERIES IN SEISMOLOGY AND GEOMAGNETISM
Francis Gun-Bayer 1969 17 p
Avail: CFSTI

The possibility of the existence of two forms of daily periods of earthquakes produced by electromagnetic forces is discussed. The forms are based on local time and universal time. An argument for the electromagnetic influences based on solar activity is given, and it is considered that two daily periods are caused by solar activity and electromagnetic forces. A discussion is also presented on the electromagnetic influence of the moon on earthquakes, and the lunar influence on geomagnetic unrest is described. Criteria for the physical reality of the 27.3 day period are itemized. The exact dates of high grade geomagnetic disturbances and storms, 1884–1968, are listed according to the solar cycles of polarity. N.E.N.

N70-16096# Royal Aircraft Establishment, Farnborough (England).
KINEMATICS OF LEE-WAVE FLOW [KINEMATIK DER LEEWELLENSTROEMUNG]
W. Georgii Jul. 1969 33 p refs Transl. into ENGLISH of West German report DLR-FB-67-20
(RAE-Lib-Trans-1334; DLR-FB-67-20) Avail: CFSTI

Starting from the dependence of a lee-wave flow on its stability and velocity, the relationship between forced lee-waves with the dimensions of the obstacle and resonance with natural waves is discussed. With regard to amplitude, it may be stated that long waves have maximum amplitudes in the high troposphere while the maximum amplitudes of shorter waves are to be found in lower layers. Short waves are reflected at the tropopause, while long waves can penetrate into the stratosphere. Disturbances of geostrophic equilibrium are responsible for the occurrence of abnormally long waves which have an influence on the weather. Author

N70-16114# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jul. 1969 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE Bulletin Mensuel, Juillet 1969]
Jul. 1969 23 p In FRENCH and DUTCH
Avail: CFSTI

Ionospheric and cosmic ray data derived from observations made at Dourbes, Belgium in July 1969 are presented. ESRO

N70-16115# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Jun. 1969 [OBSERVATIONS GEOPHYSIQUES Bulletin Mensuel, Juin 1969]
1969 40 p In FRENCH and DUTCH
Avail: CFSTI

The results of measurements carried out at Dourbes, Belgium, relating to geomagnetism, radioactivity of atmospheric dust particles, ionospheric wave reflection, seismology, cosmic rays, and atmospheric electricity are presented. ESRO

N70-16207# Naval Oceanographic Office, Washington, D.C.
HYDROLOGY OF KUROSHIO AND ADJACENT REGIONS OF THE PACIFIC OCEAN [GIDROLOGIYA KUROSIO I PRILEGAYUSHCHIKH RAYONOV TIKHOGO OKEANA]
Yu. V.Makerov 1969 48 p refs Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (Moscow), v. 90, 1967 p 102–135
(AD-695309; NOO-Trans-447) Avail: CFSTI CSCL 8/3

The region delimited by the equator, lat. 45 degrees N and long. 120 degrees and 165 degrees E is discussed with regard to the structure of upper water layer and the main currents. The phenomena are traced to the depth of 1500m. Author (TAB)

N70-16209# Environmental Data Service, Silver Spring, Md.
MEASUREMENT OF THE ANGULAR DISTRIBUTION OF THE INTENSITY OF SHORT-WAVE RADIATION FROM AUTOMATIC STRATOSPHERE BALLOONS [IZMERENIE UGLOVOGO RASPREDELENIIA INTENSIVNOSTI KOROTKOVOLNOVOI RADIATSII S AVTOSTRATOSTATOV]
A. I. German Sep. 1969 19 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 70, 1966 p 23–30
(AD-694574; ESSA-WB/T-115) Avail: CFSTI CSCL 4/1

Measurements of short-wave radiation, taken from automatic stratosphere balloons with clear skies and in the presence of solid cloud cover, are presented. A comparison between the results obtained and results of theoretical computations is given. Author (TAB)

N70-16237*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN CURRENT AND SEA SURFACE TEMPERATURE OBSERVATIONS FROM METEOROLOGICAL SATELLITES

Guenter Warnecke, Larry M. McMillin (Allied Res. Associates, Inc., Concord, Mass.) and Lewis J. Allison Washington Nov. 1969 50 p refs
(NASA-TN-D-5142) Avail: CFSTI CSCL 08C

Television and infrared sensing techniques utilized by meteorological satellites provide a very useful tool for oceanographic research. Satellite television pictures of cloud patterns overlying thermally different oceanic boundaries reveal significant features of sea surface temperature distribution. Nimbus II High Resoltuion Infrared Radiometer (HRIR) data which is sensitive in the 3.4 to 4.2 temperatures were derived from nighttime satellite radiance measurements in the absence of clouds. Comparisons with observations from low flying radiometer-equipped aircraft confirmed good absolute sea surface temperature measurements from the satellite radiometer if 3 deg to 4 K corrections for atmospheric attenuation and other losses were applied. Sea surface temperature discontinuities such as the North Wall of the Gulf Stream have been located consistently within 10 kilometers of the positions indicated by the airplane radiation data. With present techniques, primarily designed for meteorological purposes, the Gulf Stream boundary has been seen, at least in significant parts in about 50 out of 175 days. Similar results have also been obtained in analyses of the Agulhas Current boundary, the boundary between the Brazil and Falkland Currents and the Kurishio - Oyashio mixing region. Author

N70-16241# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NUMERICAL HYDRODYNAMIC MODELS FOR STEADY FLOW IN ERUPTING MAAR-TYPE VOLCANOES
G. Wayne Ullrich (M.S. Thesis) Jun. 1969 217 p refs
(AD-694069; GSF/MC/69-8) Avail: CFSTI CSCL 8/7

Numerical models for the fluid dynamics of the eruption of maar-forming volcanoes are developed and compared to three geological examples. These models are developed by considering the one-dimensional flow of a two-phase mixture of a volatile, water, and a second, condensed phase through a rough pipe. The second phase is assumed to consist of either particulate solids, or a basaltic melt. For the melt, the effect of the solubility of water in basalt is considered. Using these models, the effects of water content, duct inlet width, gravity, reservoir depth, duct shape, and relative roughness of the walls are determined. Models are then constructed for Nanwaksjiak Crater, Alaska; Nilahue Crater, Chile; and Moses Rock Dike, Utah. Author (TAB)

N70-16242# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS OF THE EXTERIOR BALLISTICS OF BLOCK EJECTA AT NANWAKSJIAK CRATER, NUNIVAK ISLAND, ALASKA
Kent J. Rohlof (M.S. Thesis) Jun. 1969 135 p refs
(AD-694067; GSF/MC/69-7) Avail: CFSTI CSCL 8/7

Nanwaksjiak Crater, a quaternary maar on Nunivak Island, Alaska, has a well-exposed ejecta blanket of ash and blocks ejected from the crater. Analysis of the distributions of the blocks provides clues to the internal flow conditions of the eruption. Methods of ballistics are applied to field data to determine block ejection velocities. Effects of atmospheric drag, block shape, launch angles, and wind on ballistic trajectories are discussed. Graphs are presented to allow determination of ejection velocities if size, launch angle, and range of the blocks are known. Block velocities are applied to two models for the interior flow in erupting maars to estimate flow parameters of the erupting medium. Author (TAB)

N70-16251# Israel Program for Scientific Translations, Ltd., Jerusalem.
PROBLEMS OF GEOCHEMISTRY ACADEMY OF SCIENCES OF THE USSR, INST. OF GEOCHEMISTRY AND ANALYTICAL CHEMISTRY JUBILEE COLLECTION
N. I. Khitarov, ed. 1969 762 p refs Transl. into ENGLISH of the publ. "Problemy Geokhimii" Moscow, Izd. Nauka, 1965 Prepared for Dept. of Interior and NSF *Its* Cat. No. 5148
(TT-68-50450) Copyright. Avail: CFSTI

Geochemical aspects of planetary evolution and the elemental composition of the earth's crust are discussed. Emphasis is placed on radioactive age determination methods and analyses of rock formations and mineral resources. For individual studies see N70-16251 through N70-16325.

N70-16256# British Columbia Univ., Vancouver. Dept. of Geophysics.
THE AGE OF THE EARTH
R. D. Russell et al *In* Israel Program for Sci. Transl., Ltd. Probl. in Geochem. 1969 p 35 - 48 refs (See N70-16251 05-13)
Copyright Avail: CFSTI

Measured isotopic ratios of terrestrial leads were evaluated by least-square method in order to determine a primary lead growth curve. The form of this curve defines a time scale along it and thus provides the interpretation for terrestrial lead isotope abundances. Positions of lead with zero age and of primeval lead isotope plots on the curve were obtained by assuming that the primary lead system of the earth remained closed to transfer of uranium and lead. The least radiogenic lead among terrestrial samples plotted on the primary curve at a point corresponding to an age of about 3300 million years; this represents the conservative estimate of the minimum age of the earth. A maximum age of 5360 million years was obtained from theories of nucleosynthesis; thus the calculated average for the earth's age was 4550 plus or minus 30 million years. G.G

N70-16257# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
CERTAIN GEOLOGICAL ASPECTS OF ZONE MELTING
A. A. Yaroshevskii *In* Israel Program for Sci. Transl., Ltd. Probl. in Geochem. 1969 p 49 - 59 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

Proposed is a zone melting model for differentiation of the earth crust that includes localized molten foci as an assumed type of inhomogeneity of the mantle. During subsequent upward shifting of the melt towards lower temperature zones, the melting temperature differs increasingly from the ambient temperature and heat is given up to surrounding rocks. As the molten focus moves up, the temperature maximum which accompanies the melt becomes more and more localized. Thus, the upward moving molten foci differ from the surrounding mantle by composition, temperature, and degree of heat localization; their composition vary continuously and becomes richer in low-melting components until they attain eventually limiting compositions. G.G

N70-16259# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
COMPOSITION OF THE CARBONACEOUS MATTER IN METEORITES
G. P. Vdovykin *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 66 - 74 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

The origin of meteorites was deducted by analyzing their relationships with carbonaceous and mineral components. Studied were: (1) interchondrite space filled with carbonaceous matter; (2) intrachondrite carbonaceous matter; (3) peripheral filling of chondrites and granules; and (4) cracks in mineral granules filled with carbonaceous matter. It was concluded that carbonaceous matter in meteorites was formed from simple gaseous compounds which, as a result of early condensation and subsequent rapid differentiation of protoasteroid matter migrated to their upper layer. The high degree of oxidation of organic matter and of the mineral phase in

carbonaceous chondrites was caused by pressure effects of volatile elements on the upper layers of the protoasteroids. The chemical composition of carbonaceous chondrides was identical with that of common chondrites except for volatile elements. G.G.

N70-16261# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.

SIMILARITIES IN THE DISTRIBUTION OF RARE-EARTH ELEMENTS IN METEORITES AND IN ROCKS OF THE EARTH'S CRUST

Yu. A. Balashov *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 85–95 refs (See N70-16251 05-13)
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An analysis of rare earth element abundances in basic rocks of the earth's crust and in achondrite and chondrite silicate meteorites showed analogies by differentiation-separation into phases rich in heavy lanthanides and yttrium and phases rich in light lanthanides. Higher concentrations of heavy lanthanides in olivine-bronzite as compared with the olivine hypersthene chondrites indicated their different locations in hypothetical asteroids. G.G.

N70-16265# Akademiya Nauk Gruzinskoi SSR, Tiflis.

EFFECT OF ISOMORPHOUS CAPTURE OF BARIUM AND MANGANESE IN THE ENRICHMENT OF POST-MAGMATIC PRODUCTS IN THESE ELEMENTS

G. Dzotsendidze Senidze *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 128–133 refs (See N70-16251 05-13)
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Genetic connections between deposits of barium and manganese and different types of igneous rocks in Transcaucasia are studied to show the effects of isomorphous capture of elements during magmatic crystallization on the composition of post-magmatic processes. Since numerous analyses established that barium content in rock series is usually directional proportional to potassium content and only barium bearing K-felspar is encountered in igneous rocks, it is concluded that Eocene volcanogenic rocks having a high percentage of bound potassium contain the barium deposits. Practically the entire barium in the Eocene magma is fixed isomorphously in K-felspar and only an insignificant amount entered residual post-magmatic products. Manganese gives similar effects since it is present in ancient crystalline and abyssal rocks as endocryptic admixture in magnesium and silicates. It is concluded that enrichment of post-volcanic hydrotherms with a given minor element of the magma depends on the degree of isomorphous capture by the crystals present and capable to capture the elements. G.G.

N70-16270# New Zealand. Dept. of Scientific and Industrial Research, Wellington. Dominion Lab.

GEOCHEMISTRY IN VOLCANIC HYDROTHERMAL AREAS

A. J. Ellis *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 176–190 refs (See N70-16251 05-13)
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Analyses of hydrothermally altered rocks, and experiments on rock/water interaction have shown that many of the typical hydrothermal elements such as chlorine, fluorine, boron and arsenic are taken into solution during the alteration of rocks by hot water. Most of the elements present in thermal waters, except chlorine, bromine, boron, and caesium appear to be limited in concentration by temperature-dependent equilibria. The heat that is evolved during the hydrothermal alteration of volcanic rocks is considerable, and may be an important factor in the heating of stored water. The compositions of both the steam and the hot water from drillholes can be interpreted to show the extent of aquifer systems and the pattern of stream and water flow underground. Assistance with directing the drilling programme in an area can thereby be given. Variations with time in the concentrations of gases in drillhole discharges can give a measure of changes in hot water levels or pressures within an aquifer. Author

N70-16272# Academy of Sciences (USSR), Moscow. Dept. of Geochemistry and Analytical Chemistry.

CONDITIONS OF SEDIMENTATION OF LOWER PROTEROZOIC FORMATIONS FROM DATA ON THE VARIATION OF ISOTOPIC COMPOSITION OF SULFUR SULFIDES

A. I. Tugarinov et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 205–162 refs (See N70-16251 05-13)
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Variations in the isotopic composition of sulfur in lower Proterozoic sediments are studied as a sensitive index of redox processes during the period 2600 to 1900 million years ago. Sulfides deposits in the sediments indicate the appearance of free oxygen in the earth's atmosphere and corresponding radical changes on earth surface. Analyses of the S-32 to S-34 ratios for isotopic sulfur composition in a collection of iron sulfides from the lower Proterozoic sequence established the following genetically different groups: (1) sulfide disseminations in pyrite-bearing rocks of much heavier than the average composition of sulfur in meteorites or on earth; (2) sediments with weak enrichment in S-34 at the begining of the Lower Proterozoic; and (3) the appearance of sulfides in alkali-amphibole schists on the margins of carbonate metasimatites as the indication of radical change from reducing to oxidizing conditions in enclosed rocks. The presence of an intense oxidizing stage during soda-carbonate metasomatism resulted in sulfur fractionation so that younger sulfides are of lighter isotopic composition. G.G.

N70-16273# Gottingen Univ. (West Germany). Mineralogie Anstalt.

A GEOCHEMICAL SURVEY OF THE DISTRIBUTION OF ZINC

K. H. Wedepohl *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 217–224 refs (See N70-16251 05-13)
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The frequency distribution of zinc content in more than 300 granitic, intermediate, and basaltic-gabbroid rocks was determined by emission spectroscopy. An average zinc content of 60 to 70 ppm was found in igneous rocks of the upper earth crust. Clays and shales which accounted for 70 to 80 percent of sedimentary rocks contained about 100 ppm; the respective zinc contents of sedimentary and igneous rocks was 80 and 65 ppm. G.G.

N70-16274# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.

GENETIC RELATIONSHIP BETWEEN SULFIDE-CASSITERITE DEPOSITS AND INTRUSIONS

V. L. Barsukov *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 225–233 refs (See N70-16251 05-13)
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A study of the metal contents of intrusive rocks in the zones of formation of sulfide-cassiterite deposits showed that the tin content of coarse grained biotite and biotite-hornblende granites was a low 4 ppm; average tin content increased in granodiorites up to 6 ppm, in quartz diorites to 7 ppm, and in quartz gabbro-diorites to 15 ppm. The boron content increased also from 10 to 40 ppm in the same sequence. In late differentiation products of granitoid melts, tin content was much lower but boron content increased to 100 ppm or more. Suggested is a connection between the hybrid nature of the granitoid melt and the metallogenic specialization of hybrid rocks with respect to tin and boron. G.G.

N70-16275# Geological Survey of Canada, Ottawa (Ontario).

THE GEOCHEMISTRY OF CADMIUM IN THE LEAD-ZINC-SILVER DEPOSITS OF THE KENO HILL AREA, YUKON, CANADA

R. W. Boyle *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 234–246 refs (See N70-16251 05-13)
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The principal primary cadmium-bearing minerals in lead-zinc-silver lodes are sphalerite (0.71 – 1.16 percent Cd) and freibergite (0.05 – 0.2 percent Cd). Galena may contain up to 200 ppm Cd, and traces are found in chalcopyrite, jamesonite, boulangerite, and pyrite. Cadmium replaces zinc in sphalerite, copper in freibergite, and probably lead in the galena. The main supergene cadmium-bearing mineral is hawleyite, isometric CdS. Small amounts of cadmium are found in supergene sphalerite, native zinc, pyrargyrite, limonite, wad, smithsonite, beudantite, bindheimite, jarosite, and anglesite. In these minerals cadmium shows a close association with zinc, lead, and antimony. The oxidized zones of most lodes are depleted in cadmium. In this respect the element behaves like zinc. Author

N70-16276# Academia R. P. R., Bucharest.
INDICATIONS OF THE TEMPERATURE REGIME OF VEIN FORMATIONS BY LIQUID INCLUSIONS
M. Savul et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 247 – 251 refs (See N70-16251 05-13)
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Stastical geothermometric analysis is used to study liquid inclusions in quartz crystals and to establish the relationships governing the temperature distribution in a mineral vein. The homogenization temperature in each crystal sampled at a given place is taken for as large a number of liquid inclusions as possible and plotted in corresponding histograms. The totality of the experiment data obtained by studying crystals from one location forms the histogram of the vein. If the source of hydrothermal solutions is at great depth, the geothermal gradient is small; if the magmatic source is located near the surface, the geothermal gradient is large. G.G.

N70-16277# Leningrad (A. A. Zhdanov) State Univ. (USSR). Earth Science Inst.
HYDRATION ENERGY, ION EXCHANGE AND MECHANISM OF FORMATION OF INTERNAL WATERS WITH CALCIUM CHLORIDE AS THE MAIN COMPONENT
V. I. Lebedev *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 252 – 265 refs (See N70-16251 05-13)
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Structure, composition, and transformations in crystalline lithogenesis during genesis of internal water are postulated and it is shown that calcium chloride waters are the products of different formation mechanisms. Waters which have not undergone halogenesis and which do not contain sulfate ions will contain large amounts of sodium; waters in contact with rocks which have undergone diagenesis will contain magnesium, etc. Waters with a low salinity and with a more than 50 percent calcium chloride content in the residue are highly mineralized waters diluted by fresh water. G.G.

N70-16278# Slovak Academy of Sciences, Bratislava (Czechoslovakia). Geological Lab.
RARE ELEMENTS IN PYRITE DEPOSITS OF THE WESTERN CARPATHIANS IN CONNECTION WITH GENETIC PROBLEMS OF MINERALIZATION
B. Cambel et al *In* Israel Program For Sci. Transl., Ltd. Probl. of Geogherm. 1969 p 266 – 284 refs (See N70-16251 05-13)
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A study of rare elements in pyrite, especially of nickel and cobalt, made it possible to determine the degree of metamorphism in sedimentogenic ores since the distribution of cobalt and nickel in coexisting pyrite and pyrrhotite is a function of the degree of metamorphism. Certain exceptions are found in pyrite ore formations of geosynclines which resulted in a nickel background of primary pyrites which was so high that the nickel content remained higher than the cobalt content even after metamorphism. Pyrite in the Carpathians indicated its sedimentogenic origin through the presence of molybdenum. Pyrite mineralization in regions of geosynclinal deposits showed that pyrites of different genetic origin types may be present together in isolated locations due to complex development conditions. G.G.

N70-16280# Academy of Sciences (USSR), Moscow. Inst. of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry.
THE POSSIBLE SIGNIFICANCE OF ELECTROKINETIC PHENOMENA IN GEOCHEMISTRY
V. A. Zharkov *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 295 – 306 refs (See N70-16251 05-13)
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Changes in acidity and alkalinity and in the compositions of solutions due to geochemical filtration effects through rock strata are investigated and the resulting filtration rates for different ions in solution are pointed put. Theoretical and experimental data show that: (1) the filtration effect is responsible for gradual alteration of the acidity of the solution; (2) the composition of the solution is also substantially altered; (3) changes in acidity, alkalinity, and composition of solutions make it possible to understand complex aspects of mineral forming, leaching, and deposition processes; (4) the electrokinetic nature of the filtration effect determines the transport mechanism of matter in hydrothermal solutions; and (5) the electrochemical mechanism of filtration determines component migration in aqueous solutions. G.G.

N70-16281# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
GEOCHEMISTRY OF CARBON ISOTOPES IN THE WEATHERING CRUST OF LIMESTONES
V. A. Grinenko et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 307 – 319 refs (See N70-16251 05-13)
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Isotopic carbon composition in secondary calcite, formed as a result of surface leaching processes, differs from that in the initial limestone. The isotopic ratio of carbon in sinter calcite corresponds to an increased C-12 content, owing to the effect of biogenic carbon dioxide. Composition of the secondary calcite reflects the changes in the isotopic composition of soil CO2 and thus also the correlation with the varying soil and climatic conditions on the ground surface. Isotopic exchange reactions are responsible for the variations in the delta C-13 value of secondary calcite, in each case in accordance with the conditions in which the deposition took place. Deposition of calcite in drainless basins in karst caves yields calcite with an isotopic composition heavier than that of other varieties of sinter forms. This heavier composition of sinter calcite is an indication of local passive circulation of underground waters. Author

N70-16282# Academy of Sciences (USSR), Moscow. Inst. of Mineral Fuels.
MODE OF INTRODUCTION OF GERMANIUM IN COAL DEPOSITS
V. M. Ratynskii *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 320 – 330 refs (See N70-16251 05-13)
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The formation of germanium rich coals was analyzed and attributed to infiltration of aqueous solutions rich in this element. Such solutions are possible results of rock weathering and minerals genetically connected with the residual magma. Germanium-rich natural springs connected with post-magmatic processess are also described. Accumulation and transformation of initial vegetation material during introduction of germanium bearing aqueous solutions is the main factor in the formation of germanium-rich fossile coals. G.G.

N70-16283# Academy of Sciences (USSR), Moscow. Crystallographic Inst.
CRYSTAL CHEMISTRY IN THE MAGMATIC CREATION OF THE WORLD OF ROCK-FORMING MINERALS

N. V. Belov *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 331–333 refs (See N70-16251 05-13)
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Effects of the high-melting basic oxides CaO and MgO on the initial formation of igneous rocks are analyzed for their crytallization behavior. Magnesium oxide is "self-crystallizing" and incorporates silica and later alumina, at first as tetrahedra and later in larger tetrahedral aggregates. Calcium oxide acts as filler and reinforcer of cavities in the continuous Si(Al) tetrahedral lattice which constitutes the original magma. With decreasing temperatures in the left branch, increasing amount of FeO are added to magnesium oxide, while in the right branch potassium becomes slowly activated but cannot participate in the initial stages of crystallization due to its large ionix radius. It enters later more acid felspars, renders them more regular shaped, and may even expand them; cavities coalescent into channels while potassium is readily eliminated due to its weak bonds to oxygen ions in the walls of the cavities. The octagonal cavities evacuated by potassium are stable and form the general base for quartz crystals that are obliquely oriented with respect to the main faces of the orthoclase crystals. G.G.

N70-16284# Hungarian Academy of Sciences, Budapest. Geochemical Lab.
GEOCHEMISTRY OF ALKALI IGNEOUS ROCKS
E. Szadeczky-Kardoss *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 334–340 refs (See N70-16251 05-13)
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Magmatic associations of alkali rocks are investigated for their compositions and petrographic relationships. Ultra-alkali rocks with feldspathoids are mainly associated with ancient shields, moderately alkali rocks containing only alkali pyroxenes and amphiboles are encountered in stable orogeneis belts, where a small group distinguished by an abundance of felspars is connected with volcanism and folded zones. Alkali magma is gradually formed in the top parts of descending foci whereas alkali basalt magma forms intrusions with well-defined contacts and is the molten product of simatic layers. Genetic difference between agpaitic and miaskitic alkali rock series is expressed in the Fe_2O_3 /FeO ratio, which is about 4.81/2.08 for agpaitic and 2.42/2.62 for miaskitic rocks. Agpiatic rocks represent a later evolution in alkali rocks and are rich in rare earth elements, Ti, Zr, Hf, U, V, Nb, Ta, B and Be. In the miaskitic development stage of alkali rocks there is an initial accumulation of barium in association with calcium carbonates; potassium, aluminum, and silicon are the main mineral accumulations. G.G.

N70-16285# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
PHASE TRANSFORMATION IN BASALT UNDER A PRESSURE OF 42,000 ATM BETWEEN 1200 AND 2000 DEG C
N. I. Khitarov et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 341–346 refs (See N70-16251 05-13)
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A high pressure appliance with uniaxial compression is used to study the specific behavior of powdered basalt under constant pressure of 42,000 atm between 1200 and 2000 C. Phase transformations are analyzed by optical and X-ray methods. Anhydrous basalt material starts melting at about 1600 C and becomes liquid at 1900 to 2000 C. The species that melt first are plagioclase and olivine; augite and magnetite melt last. The melting process is markedly inhibited under growing pressure since melting temperature increases by 20 C per 1000 atm. Thus, under a pressure of 42,000 atm the temperature range between incipient and complete fusion extends over 350 to 400 degree C and permits the differentiation of a basal melt rising from the earth mantle to the upper crust. G.G.

N70-16286# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
GEOCHEMISTRY OF LITHIUM IN NEPHEZINE SYENITES
V. I. Gerasimovskii et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 347–360 refs (See N70-16251 05-13)
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The lithium content in nepheline-bearing rocks was determined by flame spectrophotometry. A wide variation was observed in single genetic rock series with accumulations of lithium towards the end of the magmatic process: rocks of the third intrusive phase were richer in lithium than those of the second and first phases. Lithium in minerals of nepheline syenites were associated not only with magnesium and ferrous iron, but also with sodium, potassium, and fluorine. In agpaitic nepheline syenites, lithium was mainly concentrated in alkali amphiboles, alkali pyroxene and titanosilicate and zirconosilicates, while in miaskitic rocks it was concentrated in micas, amphiboles, and pyroxenes. G.G.

N70-16287# Copenhagen Univ. (Denmark). Mineralogical-Geological Inst.
ON THE MAGMATIC EVOLUTION OF ALKALINE IGNEOUS PROVINCE OF SOUTH GREENLAND
H. Soerensen *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 361–373 refs (See N70-16251 05-13)
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An outline of the geology and magmatic evolution of Southern Greenland is given. Its basement consists of suprocrustal sediments and volcanics and of infracrustal gneisses, crystaline schists, migmatites and granite. Gabbro-anorthosites are found locally in the geneissic basement. At least two periods of folding are distinguishable and isotopic age determinations give values between 2710 and 1590 million years for them. The suprocrustal formation consists of a 3000 m thick series of continental sandstone, while lavas dominate its upper part with basaltic rocks most prominent among the volcanics. Four distinct rock types make up a majority of the observed instrusions and dykes: gabbro, syenite, nepheline syenite, and granite. The presence of basaltic lavas and dykes, and early gabbroic members in the composite giant dykes and intrusions indicates that the area belongs to the gabbroic-alkaline association. G.G.

N70-16288# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
RELATIONSHIPS BETWEEN ALKALINE EARTH AND ALKALI BASALTOID SERIES
A. S. Pavlenko et al *In* Israel Program for Sci. Transl., Ltd. Probl. in Geochem. 1969 p 374–390 refs (See N70-16251 05-13)
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The Paleogene magmatism of Central Armenia is studied as a typical example of simultaneous development of alkaline earth and continental alkali basaltoid series. Mineralogical and geochemical properties and the petrogenesis of basaltoids and general features of the tholeiite and alkali-basalt series are explained by an acid-base component interaction theory. According to this theory an initial magma of given composition crystallizes out under different conditions of alkalinity and thus gives rise to petrochemically different rock series. It is postulated that the separation of the primary alkaline earth magma is due to increased potassium alkalinity into early differentiates of gabbro-peridotite and gabbro-pyroxenite compositions and a residual alkali-metal melt. Further differentiation between tholeiite and alkali magmas takes place with decreasing temperatures. G.G.

N70-16289# Academia R. P. R., Bucharest. Geological Inst.
ADVANCES IN THE MINERALOGY OF ALKALI ROCKS OF THE DITRAU MASSIF
V. Ianovici et al *In* Israel Problem for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 391–395 refs (See N70-16251 05-13)
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A well-known alkali massif occurs on the western border of the crystalline complex of the Eastern Carpathians in the upper Mures basin in the Ditrau region. The rocks consist of numerous varieties ranging from ultrabasic to the most acid rocks of the granite type. The alkali nature of these rocks is due to the abundance of Na- and K-felspars and feldspathoids. Ore veins occur in the northwest of the massif with the following paragenesis: pyrite, sphalerite, chalcopyrite, galena, monazite, xenotime, rhönite, molybdenite, as well as calcite and dolomite as vein minerals. A careful study of the minerals in these veins revealed that the Ditrau paragenesis includes another mineral which is a member of the isomorphous calcite series and has the following properties: white or gray crystals, with very good cleavage characteristic of minerals of the calcite series and a vitreous luster. This mineral is accommodated by isomorphous mixtures of Ca, Mg, Fe, Mn.
Author

N70-16290# Bulgarian Academy of Science, Sofia. Geological Inst.
SEPARATION OF RARE-EARTH ELEMENTS IN THE MAGMATIC PROCESS
E. I. Aleksiev *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 396–405 refs (See N70-16251 05-13)
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Analysis of rare earth element distributions in two intrusive rock complexes by petrographic data showed that is not possible to deduce behavioral relationships of rare earth elements in the magmatic process from studies of accessory minerals without regard to main rock-forming minerals.
G.G.

N70-16291# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
BEHAVIOR OF LEAD AND ZINC IN ROCKS OF A SINGLE INTRUSIVE PHASE (IN SYENITE INTRUSION OF NORTHERN TIEN SHAN)
R. D. Gavriln et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 406–422 refs (see N70-16251 05-13)
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The average distribution of lead and zinc as well as the ratios of Zn/Pb and K/Pb were determined in intrusions of basic rocks. Correlations between Mg, Fe, and Zn in syenites of different intrusions was poor. Different lead contents of different intrusions containing similar amounts of potassium were explained by the separation of the syenite magma from the primordial granosyenite magma which contained different initial lead amounts. Thus, distribution of lead indicates facies differentiation within a given intrusive body as different from that which takes place within an intrusive phase; the latter results from simultaneous injection of magma from various magma chambers.
G.G.

N70-16292# Warsaw Univ. (Poland.) Dept. of Mineralogy and Geochemistry.
TRACE ELEMENTS IN MINERALS OF GRANITOID MASSIFS AND IN MINERALS OF THEIR PEGMATITES
A. Polanski *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 415–423 refs (See N70-16251 05-13)
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The distribution of trace elements was studied in rock-forming minerals of igneous and metamorphic rocks in a granitoid mountain formation of Czechoslovakia consisting mainly of monzonite granites and granodiorites, with quartz, oligoclase, microline and micas as the main minerals. Observed trace elements accompanying major chemical elements were: rubidium, lithium, cesium, thallium, barium, strontium, lead, and gallium. Some vanadium and chromium was also found in biotites of the granitoid rocks.
G.G.

N70-16293# Academy of Sciences (USSR), Moscow. Inst. of Mineralogy, Geochemistry and Crystallochemistry of Rare Elements.
RARE ELEMENTS IN ULTRABASITES FROM COMPLEX MASSIFS OF ULTRABASIC AND ALKALI ROCKS (GENESIS OF CARBONATITES AND ITS CONNECTION WITH ALKALI-MAGMATISM)
L. S. Borodin *In* Israel Program for Sci. Transl., Ltd. Prob. of Geochem. 1969 p 424–435 refs (See N70-16251 05-13)
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Geological and petrographic studies on ultrabasic-alkali massifs in the Soviet Union established that these massifs are as much the results of alkali metasomatism as that of intrusive activity. Some direct connections were established between perovskite mineralization in pyroxenites and olivinites and high temperature alkali metasomatism and recrystallization of initially ore-free ultrabasites. It was shown that the intrusion of alkali magma and carbonites was preceded by a stream of alkaline solutions which reacted primarily with ultrabasites and enclosing rocks. Ore minerals in primary ultrabasites often consisted of a high-titanium variety of magnetite and chromite.
G.G.

N70-16294# Freiburg Mining Academy (East Germany). Mineralogical Inst.
DISTRIBUTION OF MINERALS AND TRACE ELEMENTS IN DIFFERENTIATED DOLERITE OF HUEHNEBERG (THURINGER FOREST)
H. J. Roesler et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 436–441 refs (See N70-16251 05-13)
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The mineral and trace element distributions in the 355 m thick dolerite sill in the Thuringer Forest are described. The results indicate that an initially homogeneous tholeiite–basaltic magma crystallized to give a strongly zone-differentiated magmamite owing to magmatic and gravitational differentiation. Further data, including the variation of the chemical composition, the chemical composition of the accessory minerals, density, susceptibility, etc., are available and will be presented elsewhere.
Author

N70-16295# Academy of Sciences (USSR), Irkutsk. Geological Inst.
ABUNDANCES OF NIOBIUM AND TANTALUM IN TRAPS
E. B. Znamenskii et al *In* Israel Program for Sci., Transl., Ltd. Probl. of Geochem. 1969 p 442–450 refs (See N70-16251 05-13)
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The distribution of niobium and tantalum in trap formations of the field shield regions of the Siberian platform are studied. Chemical analyses on 10 group samples of nondifferential traps show a fairly uniform consistency for the chemical composition of dolerites and gabbro-dolerites from different regions. Average contents of niobium and tantalum in basic rocks of the platform type are: (1) 3.2 ppm Nb and 0.46 ppm Ta in traps; and (2) 2.2 ppm Nb and 0.48 ppm Ta in basalts. A method is proposed for calorimetric determination if tantalum traces in rocks containing high amounts of titanium that involves a preliminary chemical concentration of tantalum with phenylarsonic acid, followed by determination with dimethylfluorone.
G.G.

N70-16296# Geological Survey, Washington, D.C.
ABUNDANCES OF YTTRIUM AND YTTERBIUM IN IGNEOUS ROCKS
M. Feischer *In* Israel Program for Sci. Transl., Ltd. Probl. in Geochem. 1969 p 451–457 refs (See N70-16251 05-13)
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Published and unpublished determinations (1300 for yttrium and 376 for ytterbium) have been summarized. With a few exceptions no areal variation was detected. Averages for continental igneous rocks are Y 42 + or – 5, Yb 3.6 + or – 0.4 ppm; for crustal igneous rocks, Y 34, Yb 3.4 ppm. Ultramafic rocks are low in these elements, silicic rocks somewhat higher than the average, but the average for most types of igneous rocks are nearly the same.
Author

N70-16297# Mineralogical and Geological Museum, Oslo (Norway).

SODIUM CONTENTS IN IGNEOUS AND SEDIMENTARY ROCKS

T. Barth *In* Israel Program for Sci. Transl., Ltd. Probl. in Geochem. 1969 p 458–463 refs (See N70-16251 05-13)

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Proposed is a complete geochemical cycle model for the composition of continental rocks that corresponds to the average composition of ancient sediments of geosynclinal troughs. The source of alkali metals is contained in deep-seated geosynclinal sediments which contain high amounts of sodium and potassium as a result of fixation in metaporphic minerals or deep-seated sediment recrystallization. Sodium becomes mobile during ultrametamorphism and anatexis, and alkali metals migrate from the deeper parts of the orogenic zone towards the surface. Since sodium behaves at low and medium temperatures down to the catazone as an inert substance, sodium content does not increase with increasing degree of metamorphism of the rocks so that paraschists contain more sodium than parentary sedimentary rocks. G.G.

N70-16298# State Geological Committee, Moscow (USSR). Central Lab. for Applied Geochemistry.

DISTRIBUTION OF PETROGENE ELEMENTS IN GRANITOIDS

A. A. Beus et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 464–471 refs (See N70-16251 05-13)

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In order to obtain objective data on the distribution of petrogene chemical elements in granitoids, the results of chemical analyses on about 2000 rock samples were evaluated statistically and the variation of the contents of petrogene elements was calculated and presented in tables. Average composition of granitoids in the Soviet Union gave a high SiO_2 content with lower amounts for MgO, CaO, and TiO_2. The content of alkali metals and alumina proved to be similar to earlier reported data. G.G.

N70-16299# Academia R. P. R., Bucharest. Geological Inst.

GEOCHEMISTRY OF VOLCANIC ROCKS IN THE GUTAI MASSIF

D. Giusca et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 472–477 (See N70-16251 05-13)

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The contents of elements in volcanic rocks of the Gutai massif were studied by analyzing 23 samples of andesites and dacites, both unaltered and containing chloritized hornblendes and pyroxenes. Table 1 shows the contents of Li, Be, Ba, Ti, Zr, V, Cr, Mn, Co, Cu, Ga and Pb while Table 2 shows the variation amplitudes in the contents of all elements in different samples. Table 3 shows the average contents of minor elements in the main types of the rocks studied. The average contents of most elements were found to be fairly constant. Large differences, such as were obtained for barium and lithium, are due to the small number of determinations performed; some of these are in good agreement with the average contents obtained for other types of andesites. Author

N70-16300# Academy of Sciences (USSR), Moscow. Inst. of Geology and Geophysics.

GEOCHEMISTRY OF RARE ALKALI METALS AND GALLIUM IN IGNEOUS ROCKS OF ALMALYK

S. T. Badalov et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 478–483 refs (See N70-16251 05-13)

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The contents of lithium and rubidium in igneous rocks are close to the clarke value but in the rocks themselves high contents of these elements are associated with granodiorites and syenite-diorites, the contents increasing from older to younger rocks. Rare alkali metals and gallium are distributed as follows: carrier minerals of rubidium, cesium and gallium are felspars, while the concentrator minerals for rubidium are most often biotite, while for cesium and gallium they are orthoclase, epidote and others. Alterations of igneous rocks prior to and during ore formation are frequently accompanied by the expulsion of certain rare elements. During quartzitization, sericitization, epidotization, chloritization and orthoclasitization – depending on the scale and intensity of these processes – very high concentrations of rare elements may result in individual parts of the altered rocks. Author

N70-16302# Sophia Univ. (Bulgaria).

THE GEOCHEMICAL PRINCIPLE IN THE CLASSIFICATION OF MINERALS

I. Kostov *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 393–499 refs (See N70-16251 05-13)

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Proposed is a crystallochemical classification scheme for minerals that considers the connection between anion and cation apart from the structural type. First analyzed is the nature of the anion, then the nature of the cation, and lastly the anion to cation ratio. A connection between the size of the cations and anions and their electronegativity clearly establishes the relationship between electronegative and electropositive elements and can be used to determine isomorphism between individual elements. This combination of geochemical and crystallochemical principles provides a base for classification of minerals by their structural features. G.G.

N70-16303# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.

THE MODE OF OCCURRENCE OF LEAD IN URANINITES AND PITCHBLENDS ACCORDING TO EXPERIMENTAL DATA

V. A. Kirkinskii et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 500–511 refs (See N70-16251 05-13)

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The oxidation of lead in uranium minerals was studied by indirect data and results of thermochemical analyses on uranium and lead oxides. All experimental results indicated that the bulk of bivalent lead in uranites and pitchblendes isomorphously substitutes tetravalent uranium. Phenomena which take place in the crystal lattice during radioactive decay resulted in the preservation of this unstable phase for prolonged geological periods of time. The relationship between uranium and lead was characterized as "forced" isomorphism of radioactive and radiogenic elements. G.G.

N70-16304# Moscow State Univ. (USSR).

CURIE POINTS OF NATURAL FERRITE-SPINELLIDES AS A FUNCTION OF THEIR CHEMICAL COMPOSITION

G. P. Barsanov et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 512–534 refs (See N70-16251 05-13)

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Magnetic thermoanalysis is used to determine the mineralogical structure of ferrite-spinellides in heterogeneous mixtures. Curie points followed by phase transitions of the second kind are observed on magnetite, magnesium magnetite, jacobsite, ishkulite, and titanomagnite. Obtained results show that the first exothermal maximum is produced through a thin oxidation layer on the grain surfaces of the mineral. If impurities are present in amounts of 1 percent or more, the dependence between Curie points and composition is linear and a correlation gives fairly accurate quantitative determinations of the isomorphous impurities in the crystal structure. Chemical composition of the intermediate members in such series is estimated by assuming that their Curie points lie on a straight line connecting its end members. G.G.

N70-16306# National Museum of Natural History, Paris (France). Mineralogical Lab.

PRINCIPLES AND EXPERIMENTAL ASPECTS OF

DIFFERENTIAL THERMAL ANALYSIS

J. Orcel et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 544–548 refs (See N70-16251 05-13)
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Differential thermal analysis, in which a sequency of transformations brought about by heating is recorded, is described and evaluated for its application to mineralogical analysis. When a mineral is heated different transformations are induced and accompanied by absorption or evolution of heat and resulting temperature differences between sample and inert substances are evaluated by calorimetric methods. Example studies on phyllosilicates show that the decomposition temperature curve depends on crystal structure and the nature of the action. Decomposition temperatures of oxyhydroxides are higher than those of hydroxides. G.G.

N70-16307# Academy of Sciences (USSR), Alma-Ata. Geological Inst.

THE UTILIZATION OF THERMOLUMINESCENCE IN GEOLOGY

L. N. Ovchinnikov et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 refs p 549–559 (See N70-16251 05-13)
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A number of minerals luminesce on being heated below red heat and the intensity and nature of luminescence reflects conditions of formation and parageneses as rocks and ores. Thermoluminescence is produced by the radioactivity of the medium; ionizing radiation detaches electrons from atoms in nonconducting minerals so that they attach themselves near crystal lattice defects and assume an energetic state higher than normal. The higher the content of radioactive materials in the mineral, the stronger is its radiation and the higher the number of excited electrons found in traps. Radioactive impurities in the mineral can be estimated from intensities of alpha; beta; and gamma-radiations. A direct correlation between thermoluminescence intensity and alpha radiation emitted by zirconium as well as between beta-radiation from granitoids was established. The connection between thermoluminescence, radioactivity of the medium, and length of exposure forms the principle of age determination in rocks. G.G.

N70-16308# Academy of Sciences (USSR), Moscow. Inst. of Mineralogy, Geochemistry and Crystallochemistry of Rare Elements.

VINOGRADOVITE: AN ABUNDANT TITANIUM MINERAL

E. I. Semenov. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 560–563 refs (See N70-16251 05-13)
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A detailed study of the composition and properties of a hydrated titanium sodium silicate is given. This mineral is found in several types of alkali massifs of different regions in the Soviet Union. It is identified in at least various pegmatites and hydrothermalites associated genetically with nepheline syenites. G.G.

N70-16309# Hungarian Academy of Sciences, Budapest. Geological Inst.

CRISTOBALITE IN BAT-KELLOVEY RADIOLARITES OF THE BAKONY MOUNTAINS

Gy. Bardossy et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 564–587 refs (See N70-16251 05-13)
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The Bat-Kellovey radiolarities in the Bakony Mountains contain cristobalite in large quantities. They include the following mineral modifications of cristobalite: the macrocrystalline alpha-cristobalite and the cryptocrystalline opal cristobalite. Opal cristobalite has a random unindirectional structure. alpha-cristobalite and alpha-tridymite layers alternate in this direction. Tridymite here does not appear as an independent crystalline phase, but as a structural element of opal cristobalite. The formation of tridymite layers is favored by the presence of the ions positive Al3, K, Na, Ca2, and Mg2. Author

N70-16310# Academy of Sciences (USSR), Moscow. Radium Inst.

RADIOACTIVITY OF ROCKS IN EASTERN ANTARCTICA

A. Ya. Krylov et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 588–599 refs (See N70-16251 05-13)
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Tables containing radioactivity data for Antarctic area rocks are presented. Determined were the main radioactive elements - uranium, thorium, and potassium - in all types of rocks from various accessible parts of the Antarctic coast. Of major interest are clarke concentrations for the different rock groups and their comparison with world averages. The three radioactive elements increased in both granitoids and gneisses with decreasing age; the thorium/uranium ratio sharply decreased in granitoids. G.G.

N70-16311# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.

NATURAL RADIOACTIVE ELEMENTS IN HUMUS-CARBONATE SOILS OF THE ESTONIAN SSR

V. I. Baranov et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 600–605 refs (See N70-16251 05-13)
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The distribution of the natural radioactive elements in humus-carbonate "alvar" soils of the Estonian SSR is determined by lithological properties of the soil-forming bedrock and has a regional character. In accordance with their thorium and radium contents humus-carbonate soils may be divided into four groups: (1) soils with high contents of radium and a normal content of thorium occur in the clint zone; (2) soils with nearly normal content of both radioactive elements occur in the West Estonian plain; (3) soils on Devonian carbonate rocks in South Estonia with low contents of both radioactive elements; and (4) very thin (primitive) soils on limestone eluvium (West Estonian plain) with very low contents of radioactive elements. Author

N70-16312# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.

DISTRIBUTION OF STRONTIUM 90 IN SURFACE HORIZONS OF CHERNOZEM SOILS OF THE MEADOW-STEPPE ZONE

V. I. Baranov et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 606–612 refs (See N70-16251 05-13)
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It was shown that local geographic and geochemical conditions substantially affect the distribution of strontium-90 in the Earth's crust. Strontium-90 in soils of the meadow-steppe zone is less mobile and more evenly distributed than in soils of the forest zone. The content of strontium-90 in the top horizons (0- to 20-cm) of the chernozem soils in 1961 varied between 20 times 10 to the power of minus 9 and 40 times 10 to the power of minus 9 curie/sq m. The maximum content of radioactive strontium in chernozem soils was observed in the upper part of the humus layer (2–8 cm). The 20- to 30-cm layer of leached chernozems contained somewhat larger amounts of this isotope. Author

N70-16316# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.

ORGANIC MATTER AS A FACTOR IN ROCK WEATHERING

S. M. Manskaya et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 648–660 refs (See N70-16251 05-13)
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The concentration of chemical elements during the different stages in humification of decomposition products were investigated on lichen samples separated from rock fragments. The presence of protein compounds and their amino acids, carbohydrates, and lichen acids indicated lichen decomposition during interaction with rocks. Chemical elements concentrated in living lichens growing on igneous rocks were bound as stable complexes with humic acids

at their various formation stages; humified decomposition products accumulated chemical elements from rocks on which lichens were growing and serve as substrates for subsequent plant associations. G.G.

N70-16318 Academy of Sciences (USSR), Moscow. Inst. of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry.
PERM PLAINS OF THE URALS AS A SEPARATE GEOCHEMICAL AND POSSIBLE PALEOBIOGEOCHEMICAL PROVINCE
A. I. Perelman et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 668 - 674 refs (See N70-16251 05-13)
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The existence of a special East Russian Permian paleobiogeochemical province is proposed after studies of fossile soils in the Ural. These soils were formed on red-colored alluvium as results of carbonate dissolution under conditions of leaching. Carbonate chemical analysis of fossil soil profiles showed that the Permian period soils of the Urals were of a semiarid type while the biological cycle was of the desert type. Water shortage and alkaline nature of the waters impaired the Ca/Mg and Ca/Sr ratios as well as the biological important Fe/Mn ratio for this province. Vegetation may have consisted of lower plants only. G.G.

N70-16320# Academy of Sciences (USSR), Moscow. Inst. of Oceanology.
THE AMOUNT OF PLANKTON IN THE PACIFIC OCEAN
V. G. Bogorov. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 683 - 689 refs (See N70-16251 05-13)
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Calculations were performed to estimate the zooplankton biomass throughout the Pacific Ocean from vertical biomass distribution data obtained for the principal regions of the Pacific. Considered were zooplankton biomasses in the 0- to 100-m surface layer. Data on the decrease of plankton with depth oceanic layer averages were established and the total zooplankton biomass for the Pacific Ocean was determined as about 5 billion tons. Production of organic matter by plankton and distribution of its biomass depended on abiotic and biotic conditions. Wind effected the rise and flow of nutritient substances from depths below 100 m to the surface and thus produced favorable conditions for phytoplankton development. G.G.

N70-16321# Nagoya Univ. (Japan).
TRACE ELEMENTS IN THE WORLD OCEAN
K. Sugawara. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 690 - 703 refs (See N70-16251 05-13)
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Data on the surface distribution of iodine, arsenic, molybdenum, and vanadium in different oceans and ocean areas were analyzed. It was shown that the element contents of surface layers reflects the corresponding contents in deeper layers, down to considerable depths. Contents of iodine and arsenic in surface water layers increased somewhat from the Pacific to the Indian and Antarctic Oceans; molybdenum contents remained between 0.09 and 0.13 micron grams-at/kg, whereas the contents of vanadium was more variable. G.G.

N70-16322# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
PALEOTEMPERATURES OF THE UPPER CRETACEOUS OF THE RUSSIAN PLATFORM AND OTHER PARTS OF THE SOVIET UNION FROM THE ISOTOPIC COMPOSITION OF OXYGEN IN ORGANOGENIC CALCITE
R. V. Teis et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 704 - 720 refs (See N70-16251 05-13)
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Paleotemperatures for the Russian Platform and adjoining regions were determined from isotopic oxygen composition of marine animal deposited calcite in the belemnite rostra. Multiplicate analyses of numerous samples showed that the temperature during the Upper Cretaceous remained remarkable constant; average temperatures fluctuated within a 5 degree C range between 11 and 16 degree C, most often between 13 and 16 degree C. Supplementary data obtained on external and internal layers of two Lower Maestrichtian belemnites did not show any major differences between deposition temperatures of the external and internal layers of the rostrum. G.G.

N70-16323# Museum of Mines, Stockholm (Sweden).
THE CONCEPT OF DOMAIN AND REGIONAL GEOCHEMICAL ABUNDANCES
F. E. Wickman. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 721 - 726 refs (See N70-16251 05-13)
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Considered are two variants for subdividing the earth into shells for geochemical abundance calculations in vertical dimensions: (1) a new surface is defined by a point at a constant depth from the earth surface; this operation is repeated with the new surface taking the part of the earth's surface until a number of shells are obtained. Each shell is then divided by vertical planes into a large number of parts with equal volume of domains; and (2) the earth is subdivided into a number of shells of a given thickness and then into domains as before, but the reference system used is the sea level. The latter method is preferable because of its referral to the sea level and its decisive importance in exogenic geological processes. G.G.

N70-16324# College de France, Paris. Ecole Nationale Superieure des Mines.
METALLOGENIC MAPPING METALLOTECTS AND REGIONAL GEOCHEMISTRY
P. Laffitte et al. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 727 - 730 refs (See N70-16251 05-13)
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Metallotects are defined as geological objects connected with tectonics, magmatism, metamorphism, lithology, geochemistry, etc., which may result in the formation of a mineral deposit or mineralization and which therefore are shown on metallogenic maps. Their possible relationship to mineralization is examined for temporal and spatial distribution of mineral deposits by identification of the geological features which determine the possible existence of mineral deposits. Metallogenic mapping requires selection among the stratigraphic, lihtological, paleographic, tectonic, magmatic, and metamorphic data. Geochemical metallotects usually reflect connections with other metallotects and their distribution may be associated with ancient regional metallotects deeply impressed into the lithosphere of the earth. G.G.

N70-16325# Friedrich-Schiller Universitaet, Jena (East Germany). Mineralogical Inst.
REGIONAL AND VERTICAL DISTRIBUTION OF BORON MINERALS IN ZECHSTEIN SALT DEPOSITS OF THE CYCLES OF STRASSFURT, LEINE AND ALLER IN MIDDLE AND NORTH GERMANY
F. Heide. *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 731 - 752 refs (See N70-16251 05-13)
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Mineralogical and petrographic analyses of salt deposits in middle and north Germany show that boracite is present in all accessible ore deposits and ascharite in almost every deposit; both minerals are most abundant in vertical sections. While distributions of stassfurtite and ascharite are fairly similar, enrichment in boracite is encountered in tectonic zones and on the boundary of impoverished zone. Dispersive boron provides the material for secondary boron minerals by entering the lattices of anhydrite and minerals of salt-bearing clays or is admixed or absorbed by claylike rocks. Boron minerals in marine salt deposits of the Zechstein sediment layer are shown graphically, they exhibit similar distribution characteristics as encountered in other rock salt regions. G.G.

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THE VERTICAL CIRCULATION AND THE STATUS OF FRONTAL ZONES IN THE CENTRAL PART OF NORTH ATLANTIC
V. M. Gruzinov 28 Jul. 1969 6 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 4, no. 3, 1964 p 408–411
(NLL-NIOT-130-(9022.7)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Vertical movements due to drift and convective-gradient circulation in the frontal zones and adjacent regions of the central North Atlantic were examined. Vertical velocity of these movements, as a sum of the drift and convective-gradient components, was calculated from formulas used in a similar study of the Pacific Ocean. Results of the calculations reveal the existence in spring and autumn of a subpolar front and a second front to the north. D.L.G.

N70-16334*# Denver Research Inst., Colo. Industrial Economics Div.
A STUDY OF GEMINI AND APOLLO PHOTOGRAPHY USERS
Robert W. Joselyn Oct. 1969 55 p refs
(Contract NSR-06-004-063)
(NASA-CR-107728) Avail: CFSTI CSCL 08F

A study to increase NASA's and the Technology Applications Center's (TAC) knowledge of the characteristics of users and uses made of Gemini/Apollo photographs is reported. The research was designed to accomplish: (1) identification of market segments, (2) determination of how customers used the photographs, (3) evaluation of the economic benefits derived through the use of TAC-supplied Gemini/Apollo photographs, (4) measurement of user satisfaction, and (5) suggestions for the marketing of photographic materials. It is concluded that almost half of the customers of TAC are academicians, primarily at the university level, and that the current promotional program lacks balance. F.O.S.

N70-16337# Naval Oceanographic Office, Washington, D.C.
SOME DATA ON WAVE MOTION IN THE CASPIAN SEA [NEKOTORYE DANNYE O VOLNENII NA KASPIISKOM MORE]
B. A. Shlyamin 1969 6 p Transl. into ENGLISH from Tr. Akad. Nauk SSSR, Okeanogr. Komis. (Moscow), v. 5, 1959 p 220–221
(AD-695303; NOO-Trans-453) Avail: CFSTI CSCL 20/4

Experimental and theoretical data on wave pressure against the pier are compared, showing the significance of wave height and length. TAB

N70-16338# Naval Oceanographic Office, Washington, D.C.
PERMANENT CURRENTS IN THE CASPIAN SEA [O "POSTOYANNYKH" TECHENIYAKH V KASPIYSKOM MORE]
B. A. Shlyamin 1969 12 p refs Transl. into ENGLISH from Tr. Okeanogr. Komis., Akad. Nauk SSSR (Moscow), v. 5, 1959 p 203–213
(AD-695304; Trans-454) Avail: CFSTI CSCL 8/3

Current and wind observations conducted in the Caspian Sea show that the pattern is rather complex, changing with regions and seasons of the year. In N and S Caspium clockwise currents prevail, while in Central Caspium they are often reversed. Author (TAB)

N70-16377# Joint Publications Research Office, Washington, D.C.
THE OCEAN: A BLUE FERTILE FIELD
Oleg Popov 24 Dec. 1969 11 p Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow), 23 Nov. 1969 p 4
(JPRS-49506) Avail: CFSTI

A state of the art review of underwater exploration is presented. Particular emphasis is placed on Soviet underwater technology. Discussion is centered upon the vast potential of resources available to mankind through exploitation of the worlds ocean depths. D.L.G.

N70-16397# Naval Oceanographic Office, Washington, D.C.
RATE OF SEDIMENTATION IN DEEP WATER [SKOROSTI NAKOPLENIYA GLUBOKOVODNYKH OSADKOV]
L. A. Karistyanova and Y. A. Romankevich 1969 18 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Komis. Po Izuch. Chetvertichnogo Perioda Byul., (USSR), no. 35, 1968 p 20–30
(AD-695305; NOO-TRANS-458) Avail: CFSTI CSCL 8/10

Investigations carried out by several expeditions concerning the rate of sedimentation in the Atlantic, Pacific and Indian Oceans are discussed and evaluated. Similarly, the results of various sampling and calculation methods are compared and evaluated, namely: radium, radio-ionic, ionic, ionic and thorium, beril, protactinium-ionic and radio carbon methods. On the basis of such analyses, the most dependable rates of sedimentation for red clay are found. TAB

N70-16427 Radio and Space Research Station, Slough (England).
THE PHYSICAL PROPERTIES OF THE LOWER IONOSPHERE
J. A. Ratcliffe *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 3–4 (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

A general review of the physical properties of the lower ionosphere and of the D-region in particular is presented. Details were given of the electron production and loss processes likely to occur in this region of the ionosphere and some of the difficulties associated with the theoretical determination of the electron density height distribution were examined. Recent experimental measurements of D-region parameters by both radio and rocket techniques were reviewed and their significance discussed. Author

N70-16428* Norwegian Defence Research Establishment, Kjeller
MEASUREMENTS OF ELECTRON DENSITY IN THE UNDISTURBED MIDDLE LATITUDE D-REGION
E. V. Thrane *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 5–8 refs (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

The purpose of this chapter is to present some results from an experimental study of the undisturbed D-region at middle latitudes. Two different ground based techniques for measuring the electron densities below 90 km were used during the IQSY at Crete. The two methods were the partial reflection method, and the pulsed ionospheric wave interaction technique. The electron densities have been averaged over solar zenith intervals of 10 degrees. In the analysis a collision frequency model was assumed, based on the atmospheric pressure for middle latitudes. It will be seen that at any particular height there is a fairly smooth and systematic change of electron density with solar zenith angle. Author

N70-16429* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROCKET MEASUREMENTS OF THE LOWER IONOSPHERE
J. A. Kane *In* AGARD Oblique Ionospheric Radiowave Propagation Jun. 1969 p 9–24 refs (See N70-16426 05-07)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (attn. Mr. A. L. Candido)

Some rocket techniques currently being used to obtain electron density profiles in the D-region are described. Rocket

results from both the auroral zone disturbed and the mid-latitude quiet D-region are presented together with a discussion of the available knowledge of the ionization production processes. Attention is also given to the electron collision frequency problem. The latitudinal and seasonal variability of this ionospheric parameter is discussed with respect to large scale meteorological circulation patterns in the upper stratosphere and mesosphere. Author

N70-16469# Technische Hochschule Munchen (West Germany)
IONIC CLOUD EXPANSION IN EARTH MAGNETIC FIELD [EXPANSION EINER IONENWOLKE IM ERDMAGNETFELD]
Werner Pilipp (Ph.D. Thesis) 2 Jul. 1969 194 p refs In GERMAN
Avail: CFSTI

This theoretical evaluation of ionic cloud expansion in a homogeneous magnetic field considers the physical conditions present during the Heos-cloud experiment in March, 1969. A qualitative description depicts barium ion cloud development from a neutral barium cloud through sun light effects and the propagation of the developed ion cloud in the magnetic field of the earth. Mathematical models are formed to calculate vertical propagation in the magnetic field from basic equations for one dimensional plasma flow with infinite conductivity. Three dimensional plasma diffusion parallel to the magnetic field and external magnetic field disturbance effects on the cloud are approximated. Also considered is the energy balance in the expansion velocity of the ion cloud parallel to the magnetic field which is higher than that for a neutral particle cloud. It is shown that the effects of magnetospheric plasma in the outer region of the magnetosphere do not influence cloud propagation and that scalar themal pressure is responsible for microinstabilities that cause plasma turbulence. It is assumed that the microinstabilities do not markedly effect electron conductivity. Transl. by G.G.

N70-16586# Akademiya Nauk URSR, Kiev.
PROSPECTS FOR THERMAL WATER EXPLORATION IN TRANSCARPATHIAN REGION OF UKRANIAN SSR
I. A. Mesyets, B. A. Kotyk, and L. P. Myshkin *In its* Mining Thermophysics 1968 p 15–18 In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

Geothermal conditions and thermal water distribution resources within the Transcarpathian region are discussed. Sites most promising for thermal water prospecting operations are specified. Transl. by E.C.

N70-16587# Akademiya Nauk URSR, Kiev. Ukrgeofizrazvedka Trust.
RESULT OF GEOTHERMAL MEASUREMENTS IN DEEP BOREHOLES OF PETROLEUM-BEARING REGIONS OF THE UKRAINE
A. A. Potushanskij *In its* Mining Thermophysics 1968 p 19–24 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

Temperature measurements in deep boreholes are summarized. Temperatures higher than 100 C were recorded in ten boreholes. Predicted temperatures for rocks are given for depths up to 7000 meters. The potential of the petroleum-bearing regions of the Ukraine as a plentiful source of thermal energy is emphasized. Transl. by E.C.

N70-16588# Akademiya Nauk URSR, Kiev.
FILTRATION OF HEAT CARRIERS IN EARTH CORE ROCKS AT A DEPTH OF FROM 6 TO 8 KILOMETERS
V. S. Gorbenko, V. P. Ponomarev, and A. I. Fialko *In its* Mining Thermophysics 1968 p 25–30 refs In RUSSIAN (See N70-16584-05-33)
Avail: CFSTI

Crack characteristics in rocks at depths of from 6 to 8 kilometers are examined. Results of theoretical and experimental investigations support the feasibility of constructing an 'underground boiler' system for generating thermal energy at these depths. A reliable filter system for heat conductors is also considered. Transl. by E.C.

N70-16589# Akademiya Nauk URSR, Kiev.
PRESSURE EFFECTS ON FILTRATION OF A HEAT CARRIER IN EARTH CORE ROCKS
A. S. Tsyrulnikov and A. I. Fialko *In its* Mining Thermophysics 1968 p 31–35 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

Laboratory measurements of pressure effects on the permeability of rocks are reviewed. Results are given for comprehensive external pressure measurements on 8 sandstone-type and 4 close-grained metamorphized rocks with permeability levels of from 1.78 m-darcy to 20 darcy. Pressures ranged between 25 and 600 atm. A non-polar purified kerosene liquid filter was used. The porosity, density, and pore structure of the rocks was also determined. A formula is derived for calculating permeability variations in rocks due to applied pressure. Transl. by E.C.

N70-16590# Akademiya Nauk URSR, Kiev.
CALCULATIONS ON BOILER APPARATUS FOR EXPLOITING SUB-SURFACE HEAT SOURCES
A. V. Shurchkov *In its* Mining Thermophysics 1968 p 36–40 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

A formula is proposed for estimating optimized annual costs of a geothermal installation for exploiting underground heat sources. Parameters considered include the number of boreholes, their depth, and temperature drop measurements. Cost estimates for mining operations would be calculated in terms of the annual output of thermal energy. Data on deductions from capital outlay for equipment, maintenance costs, and expenditures for the electrical energy to power the heat transfer circulation system would be included in the calculations. Transl. by E.C.

N70-16591# Akademia Nauk URSR, Kiev.
MINING THERMAL-PHYSICS IN SHAFTS AND PITS IN NORTHERN REGIONS
Yu. D. Dyadkin (Leningrad Mining Inst.) *In its* Mining Thermophysics 1968 p 41–51 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

Theoretical and experimental methods are assessed for predicting and controlling thermal processes in underground mining operations among the frozen rocks and permafrost in the northern and northeastern sectors of the Soviet Union. Mining problems due to the seasonal extreme fluctuations in temperature in these regions are cited. Transl. by E.C.

N70-16593# Akademiya Nauk URSR, Kiev.
HEAT TRANSFER IN FLOW PROCESSES FROM DEEP BOREHOLES
Yu. P. Dobryanskiy, E. I. Baratov, and B. P. Chernyak *In its* Mining Thermophysics 1968 p 59–65 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

The methodology and results are outlined for modeling the process of heat transfer between the flow in a borehole and the surrounding rock mass by considering the eccentricity of the pumping column. Values are obtained for the coefficients of effective thermal conductivity of the intertubular space for different filling media. Transl. by R.B.

N70-16602 Texas A&M Univ., College Station.
A NUMERICAL MODEL FOR PREDICTING THE DIFFUSION OF SULFUR DIOXIDE IN THE ATMOSPHERE
Darryl Randerson (Ph. D. Thesis) 1968 168 p

Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-5148

A numerical model is proposed for predicting the disperson of SO2 over Nashville, Tennessee, during the winter. The model includes the effects of three-dimensional advection, diffusion, and variations in the topography. Also included in the numerical solution are the effects of chemical decay, source strength, and a correction term for the truncation error. A variable, vertical exchange coefficient is incorporated in the diffusive portion of the model. These terms represent the complete transport equation which is numerically integrated for a period of 2 hr in three-dimensional space. Initial conditions are based on aerometric and meteorological data acquired in Nashville, Tennessee, during the period 1958-1959. These data are used to establish the three-dimensional distribution of emissions of SO2. Dissert. Abstr.

N70-16604# Centre National de La Recherche Scientifique, Paris (France).
PROCEEDINGS OF THE SYMPOSIUM ON ATMOSPHERIC OZONE [COMPTE-RENDU DU SYMPOSIUM SUR L'OZONE ATMOSPHERIQUE]
A. Vassy, ed. (Paris Univ.) May 1969 255 p refs Partly in FRENCH and partly in ENGLISH Conf. held at Monaco, 2 - 7 Sep. 1968; Sponsored by UGGI and World Meteorol. Organ.
Avail: CFSTI

Conference papers are presented on various aspects of the photochemistry of atmospheric ozone, ozone in the vicinity of the earth, vertical distribution, rocket and satellite measurements, and general circulation and ozone distribution. For individual titles, see N70-16605 through N70-16643.

N70-16605# National Center for Atmospheric Research, Boulder, Colo.
SOME CHARACTERISTICS OF THE TOTAL OZONE DEDUCED FROM DOBSON-SPECTROPHOTOMETER AND FILTER-OZONOMETER DATA AND THEIR APPLICATION TO A DETERMINATION OF THE EFFECTIVENESS OF THE OZONE STATION NETWORK
Rumen D. Bojkov (State Univ. of New York) *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 41 - 47 refs (See N70-16604 05-13)
Avail: CFSTI

Statistical characteristics (such as standard deviation, structural and correlation functions, etc.) of the total ozone measurements at a number of stations equipped with Dobson spectrophotometers or with filter ozonometers are discussed. Analysis of these characteristics makes it possible to determine some requirements for maximum effectiveness of the ozone network. It is found that at middle and polar latitudes the optimal distance between ozone stations should be about 600 - 900 km. Special attention is given to the unique parallel measurements with the Dobson spectrophotometer and filter ozonometer M-83 performed during one full year at the University of Sofia. The M-83 is a working instrument in about one third of the world's ozone network, and is predominantly used in the USSR. Observations taken every 1515 minutes on clear sunny days, as well as the monthly and seasonal values, show that the filter ozonometer gives a reading of about 6% less ozone than the Dobson spectrophotometer. Author (ESRO)

N70-16610# Meteorological Service of Canada, Ottawa (Ontario).
MERCURY RECTIFIER FOR THE DOBSON SPECTROPHOTOMETER
R. A. Olafson *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 (See N70-16604 05-13)
Avail: CFSTI

A relay driven by a transistor circuit which receives synchronizing pulses from an auxiliary chopper and a photosensor was designed to remove motor troubles encountered with a Dobson spectrophotometer. ESRO

N70-16612# Meteorological Service of Canada, Ottawa (Ontario).
COMPUTER EVALUATION OF TOTAL OZONE OBSERVATIONS
J. Lortie *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 67 - 71 refs (See N70-16604 05-13)
Avail: CFSTI

A FORTRAN 4 computer program was developed for quality control and to calculate routine total ozone measurements and lamp tests for the Dobson ozone spectrophotometer. Sky and cloud nomograms are fed to it in the form of numerical arrays which can be easily amended. Further, it sets up files of correct data for research as well as a continuous record of lamp test results to monitor instrument stability. Author (ESRO)

N70-16613# Eidgenossische Technische Hochschule, Zurich (Switzerland). Lab. fuer Atmosphaerenphysik.
THE CURRENT PROBLEMS OF THE PHOTOCHEMICAL THEORY OF STRATOSPHERIC OZONE
H. U. Duetsch and Theo Ginsburg *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 75 - 76 refs (See N70-16604 05-13)
Avail: CFSTI

An equilibrium equation for ozone concentration was developed for the Thompson model assuming reactions of oxygen and ozone with active hydrogen compounds. ESRO

N70-16614# Stockholm Univ. (Sweden). Inst. of Meteorology.
DETERMINATION OF PARAMETERS APPEARING IN THE OXYGEN - HYDROGEN ATMOSPHERE
Paul Crutzen *In* Proc. of Symp. on Atmospheric Ozone May 1969 p 77 - 81 refs Submitted for publication (See N70-16604 05-13)
Avail: CFSTI

The photochemistry of the ozone between 30 and 35 km was investigated. It was indicated in this work that the ozone concentrations above 30 km between 0 deg and 45 deg latitude, except during the winter and early spring are mainly determined by photochemical processes. Parameters appearing in the Hampson-theory (hydrogen - oxygen atmosphere) for the ozone are determined by fitting them to the mean ozone observations obtained from the Umkehr method. The results obtained are not satisfying. Author (ESRO)

N70-16615# Paris Univ. (France). Inst. d'Astrophysique.
ABSORPTION COEFFICIENTS OF OZONE IN THE HARTLEY BAND [COEFFICIENTS D'ABSORPTION DE L'OZONE DANS LA BANDE DE HARTLEY]
E. Vigroux *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 85 - 88 refs In FRENCH; ENGLISH summary (See N70-16604 05-13)
Avail: CFSTI

Verification of the absorption coefficients of ozone around the maximum of the Hartley band. Author (ESRO)

N70-16616# Meteorological Research Inst., Tokyo (Japan).
AURORAL X-RAY AND ATMOSPHERIC OZONE—A PRELIMINARY CONSIDERATION
K. Sekihara *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 91 - 96 refs (See N70-16604 05-13)
Avail: CFSTI

In order to explain the decrease of ozone in the auroral zone during a strong geomagnetic storm, which was pointed out by the author, the ionizing effect of bremsstrahlung of the auroral X-rays was treated quantitatively. The ionizing effect at 40 - 60 km level is at least one order larger than that at 30 km. The order estimation of the reaction rate including ion chemistry was done and it is found out that the ionizing effect will cause ozone decrease by the process of NO-molecule production. Author (ESRO)

N70-16617# Oslo Univ. (Norway). Inst. of Geophysics.
A PHOTOCHEMICAL MODEL FOR THE OZONE LAYER
Eigil Hesstvedt *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 99 - 100 ref Submitted for publication (See N70-16604 05-13)
Avail: CFSTI

The variation of the number density of ozone due to photochemistry alone may be reaction rates and pressure. It is suggested that, in stratospheric circulation studies, a sufficient degree of accuracy is obtained when a computed standard distribution in space of water is used. Author (ESRO)

N70-16618# Technische Hochschule Munchen (West Germany).
CHEMICAL, ATMOSPHERIC AND SOLAR EFFECTS ON THE MERIDIONAL DISTRIBUTION OF OZONE
Reiner Gebhart *In* CNRS Proc. of Symp. of Atmospheric Ozone May 1969 p 101 - 106 refs (See N70-16604 05-13)
Avail: CFSTI

A time-dependent study of the formation, distribution, and destruction of atmospheric ozone is made for a meridional plane between 15 km and 45 km under the assumption of zonal symmetry. Included are time -effects of photochemistry, advection, and turbulence, using presently available information on theoretical and observational data. In the photochemical calculations the equations of a pure oxygen photochemistry and solar ultraviolet energy data obtained from recent rocket observations are used. Murgatroyd and Singleton's results of a possible meridional circulation and Prabhakara's pattern of large-scale eddy diffusion, derived from the spread of radioactive tungsten in the stratosphere, are assumed to be the basic transport mechanisms. The relatively largest seasonal variations of the ozone-concentration take place in the upper stratosphere with a maximum concentration in the high-latitude winter-hemisphere. Author (ESRO)

N70-16619# Paris Univ. Lab. de Physique de l'Atmosphere.
PRODUCTION OF ATMOSPHERIC OZONE BY SILENT DISCHARGES [PRODUCTION D'OZONE ATMOSPHERIQUE PAR LES DECHARGES SILENCIEUSES]
J. Papet-Lepine and A. Vassy *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 113 - 115 refs (See N70-16604 05-13)
Avail: CFSTI

The variations of the ozone concentration at ground level and the electrical phenomena (long and short period) which occur during a thunderstorm are recorded; comparison of these data show that ozone is produced during the first stage of the development of a stormy cell, before the discharges (cloud to cloud, or cloud to earth). Silent discharges near the ground level, in the vicinity of the storm, are the most probable factor of ozone production. Ozone production in the cumulonimbus is not excluded, but only by pre-discharges. Author (ESRO)

N70-16620# Paris Univ. (France). Inst. d'Astrophysique.
VERTICAL DISTRIBUTION OF ATMOSPHERIC OZONE DEDUCED FROM EMISSION AND ABSORPTION OBSERVATIONS OF THE 9.6 MU BAND [DISTRIBUTION VERTICALE DE L'OZONE ATMOSPHERIQUE D'APRES LES OBSERVATIONS EN EMISSION ET ABSORPTION DE LA BANDE 9,6 MU]
E. Vigroux *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 121 - 126 refs In FRENCH; ENGLISH summary (See N70-16604 05-13)
Avail: CFSTI

New assumptions for the reduction of the 9.6 micron ozone band observations through the atmosphere, in absorption and emission, with a view to determine the vertical distribution of atmospheric ozone are made. These hypotheses take largely account of the excellent and very numerous ozone soundings obtained these last years in the SA. Author (ESRO)

N70-16621# Paris Univ. (France). Inst. d'Astrophysique.
AN EXAMPLE OF THE ATMOSPHERIC OZONE EMISSION SPECTRUM [EXEMPLE D'EMISSION DE L'ATMOSPHERE TERRESTRE A GRANDE DISPERSION]
P. Vermande *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 127 - 128 In FRENCH Sponsored by DRME (See N70-16604 05-13)
Avail: CFSTI

An example of the atmospheric ozone emission spectrum obtained with the Mont-Louis grid spectrometer and a 800 channel analyzer is presented. The aim was to test the operation of the grid spectrometer associated with an analyzer. The spectrogram is compared with a relevant one in the Migeotte Atlas. ESRO

N70-16622# Physical Research Lab., Ahmedabad (India).
THE SECOND UMKEHR OBSERVED IN ZENITH SKY TWILIGHT AND ITS INTERPRETATION
K. R. Ramanathan, P. D. Angreji, and G. M. Shah *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 129 - 134 refs (See N70-16604 05-13)
Avail: CFSTI

Zenith sky Umkehr observations were made with a Dobson spectrophotometer at Ahmedabad on three wavelength pairs A, C, and D from 1962 to 1965. The observations extended to times when the sun was 8 deg to 10 deg below the horizon. They show the existence of two more reversals after the normal Umkehr. The later Umkehrs on the D wavelength pair occurred when the sun was lower down than when observations were made on C and A. Taking the difference Umkehrs A-C, A-D or C-D, all of them show reversals when the solar depression below the horizon is 5 deg to 6 deg. On a number of occasions when the Umkehr observations were taken, twilight sky intensities at 70 deg from the zenith in the sun's meridional plane were also measured, and the maximum rate of change of intensity with change in the height of the grazing rays of the sun was found to occur when the solar depression was 5 deg to 6 deg. Author (ESRO)

N70-16623# Eidgenossische Technische Hochschule, Zurich (Switzerland). Lab. fuer Atmosphaerenphysik.
SIMULTANEOUS UMKEHR OBSERVATIONS WITH TWO INSTRUMENTS
H. U. Dutsch, P. Boller, and Ch. Ling *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 135 - 138 (See N70-16604 05-13)
Avail: CFSTI

Simultaneous Umkehr observations with two Dobson photometers give quite satisfactory agreement of results on vertical distribution up to 25 - 30 km, both with respect to mean values and day-to-day variability. Considerable deviations exist between the mean ozone concentrations obtained from the two instruments for the upper stratosphere. The results on these high layers are apparently very sensitive to small calibration errors and presumably to a somewhat unsatisfactory sensitivity of one of the instruments. Author (ESRO)

N70-16624# Eidgenossische Technische Hochschule, Zurich (Switzerland). Lab. fuer Atmosphaerenphysik.
CRITICAL COMPARISON OF THE DETERMINATION OF VERTICAL OZONE DISTRIBUTION BY THE UMKEHR METHOD AND BY THE ELECTROCHEMICAL SONDE
H. U. Dutsch and Ch. Ling *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 139 - 142 ref (See N70-16604 05-13)
Avail: CFSTI

Results from the 15 months of soundings with the Brewer - Mast electrochemical sonde at Thalwil and of simultaneous Umkehr observations at nearby Arosa are compared and the results discussed with regard to seasonal differences and with respect to the type of distribution associated with different values of the total amount. Author (ESRO)

N70-16628# Cologne Univ. (West Germany). Inst. of Geophysics and Meteorology.

VARIATION OF THE VERTICAL OZONE PROFILE OVER MIDDLE EUROPE FROM 1951 TO 1968

Hans-Karl Paetzold *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 167 - 169 (See N70-16604 05-13)

Avail: CFSTI

From 1951 to 1968, the vertical ozone profile was measured over middle Europe with an optical ozone sonde. The summary of the results are given. Several possible explanations for the observed effects are discussed. Author (ESRO)

N70-16629# Meteorological Office, Poona (India).

VARIATIONS IN THE VERTICAL DISTRIBUTION OF OZONE OVER INDIA

A. Mani and C. R. Sreedharan *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 171 - 179 refs (See N70-16604 05-13)

Avail: CFSTI

Results of ozone soundings made at three stations in India during 1965 - 1968, with a Brewer type electrochemical ozone sonde developed at Poona, are presented. The general pattern of vertical distribution of ozone is the same in all seasons, with a pronounced single maximum at about 25 - 28 km with partial pressures of the order of 130 - 150 micron mb. But marked variations in the ozone content occur in the lower stratosphere, between the level of the ozone maximum and the tropopause. Significant variations in the tropospheric ozone amount are also noticed with high values during the dry summer months and uniformly low values during the moist monsoon months when ozone is destroyed in the presence of water vapor and clouds. The ozone concentration is more or less constant with height, the minimum occurring just below the tropopause. The causes of the latitudinal anomaly in the ozone distribution over India in summer and the relationship between ozone changes and the quasi-wintry oscillation are discussed. Author (ESRO)

N70-16630# Osservatori Scientifici Sperimentali di Meteorologia Aeronautica, Cagliari (Italy).

DIRECT MEASUREMENTS OF THE ATMOSPHERIC OZONE VERTICAL DISTRIBUTION OVER CAGLIARI [MESURES DIRECTES DE LA CONCENTRATION DE L'OZONE ATMOSPHERIQUE SUR LA VERTICALE DE CAGLIARI]

N. Mattana, F. Repetto, and A. Serra *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 181 - 188 refs In FRENCH; ENGLISH summary (See N70-16604 05-13)

Avail: CFSTI

During the years 1967 and 1968, the experimental scientific Observatory of Aeronautical Meteorology of Cagliari realized direct measurements, with electrochemical sondes launched by balloons. Initially the ozone soundings were realized two times a month, and since September 1967, soundings are performed every Wednesday. Principal characteristics of the ozone sonde construction and utilization are described, and a preliminary analysis of the obtained data corresponding to the ozone distribution on the vertical of Cagliari is presented. Author (ESRO)

N70-16631# Eidgenossische Technische Hochschule, Zurich (Switzerland). Lab. fuer Atmosphaerenphysik.

ONE AND A HALF YEARS OF ROUTINE OBSERVATIONS OF VERTICAL OZONE DISTRIBUTION NEAR ZURICH, SWITZERLAND

H. V. Duetsch, W. Zuellig, and Ch. Ling *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 189 - 200 refs (See N70-16604 05-13)

Avail: CFSTI

Soundings with the electrochemical ozone sonde (Brewer - Mast type) were made regularly three times a week near Zurich (Switzerland) since November 1966. In the mean of 230 flights the integrated ozone content of the atmosphere (corrected for ozone above burst level) was found to be almost 20 percent smaller than the total amount simultaneously observed at nearby Arosa. The time cross section representing the seasonal variation of vertical ozone distribution is rather similar to that constructed from the Boulder material (550 flights during three years). Below the level of the ozone maximum the seasonal variation at different levels is quite similar to that observed over Boulder. Considerable differences in the ozone regime resulted between the first and second winter of this observation series. They are compared with the temperature variations. Author (ESRO)

N70-16632# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).

OZONE AND TEMPERATURE CHANGE IN THE UPPER STRATOSPHERE

W. Attmannspacher *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 201 - 205 refs (See N70-16604 05-13)

Avail: CFSTI

Since 1965, mainly once a week, ozone soundings were made at the Observatory Hohenpeissenberg, Germany, using Regener respectively Brewer ozone sondes. Statistical studies on the behavior of the vertical temperature profiles in the upper stratosphere as a function of the vertical ozone profiles show that the temperatures are higher (lower) than normal in the case of higher (lower) ozone concentration. The same result is shown by the behavior of the vertical ozone profiles as a function of the vertical temperature profiles. The result is independent on the type of ozone sonde. A nearer check of the behavior of the vertical profiles in steps of 5 km and the statistical studies of daily ozone soundings from Boulder, USA, yield to the conclusion that the change of the ozone concentration in the upper stratosphere seems to take place earlier than the corresponding change of air temperature. Author (ESRO)

N70-16633# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.

TWENTY ONE MONTHS OF REGULAR ELECTROCHEMICAL OZONE SOUNDINGS OVER BERLIN (GERMANY)

E. Maedlow *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 207 - 212 (See N70-16604 05-13)

Avail: CFSTI

From 129 flights of Brewer - Mast electrochemical ozone sondes from November 1966 to July 1968, time cross-sections of meteorological and ozone parameters were prepared. This was done from the quantities themselves as well as from their changes from the first to the second year of observation. The major stratospheric warming in winter 1967 - 1968 was accompanied by a sharp increase of ozone partial pressure at the ozone peak. It seems that this cannot be fully interpreted by a corresponding increase of total ozone so that subsidence from higher levels may be assumed. Corresponding circulation patterns are presented. Author (ESRO)

N70-16634# Eidgenossische Technische Hochschule, Zurich (Switzerland). Lab. of Atmospheric Physics.

STATISTICAL ANALYSIS OF THE THREE-YEAR TEST SERIES OF OZONE SOUNDINGS AT BOULDER, COLORADO

Th. Ginsburg *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 213 - 222 refs (See N70-16604 05-13)

Avail: CFSTI

The three-year test series of Boulder (1963 - 66), including more than 500 soundings (Brewer - Mast electrochemical sonde) for the measurement of the vertical structure of the ozone distribution, provides for the statistical analysis of these data. The goal is an instructive representation of the condensed observational data material emphasizing the characteristic elements of the climatologic behavior of the ozone distribution at certain locations. Author (ESRO)

N70-16635# Naval Weapons Center, China Lake, Calif. Research Dept.

ROCKET MEASUREMENTS OF OZONE OVER HAWAII

Arlin J. Krueger *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 225-229 refs Prepared jointly with Metrophys., Inc. (See N70-16604 05-13)

(NASA Order R-05-030-004) Avail: CFSTI

During September and October 1967, the high altitude distribution of ozone was measured on six occasions over the Hawaiian Islands. The soundings were made using an optical ozone sonde onboard Arcas rockets. Although some variations apparently exist between soundings, no systematic trends are apparent. The average distribution between 38 and 52 km can be represented, within experimental error, by the function in cm/km and h is height in km. The accuracy of the measurements and the extent of agreement with photochemical theory will be discussed. Author (ESRO)

N70-16636# Paris Univ. (France). Lab. de Physique de l'Atmosphere.

STUDY OF THE VERTICAL DISTRIBUTION OF THE ATMOSPHERIC OPTICAL DENSITY IN THE NEAR ULTRAVIOLET BY MEANS OF PASSIVE SATELLITES [ETUDE DE LA REPARTITION VERTICALE DE LA DENSITE OPTIQUE DE L'ATMOSPHERE DANS LE PROCHE ULTRAVIOLET A L'AIDE DE SATELLITES PASSIFS]

P. Rigaud *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 231-235 refs In FRENCH; ENGLISH summary (See N70-16604 05-13)

Avail: CFSTI

A spectrophotometer which allows the study of the entry of the artificial satellites of the Echo type in the earth's shadow was realized. The vertical distribution curves of the atmospheric optical density shows, at an altitude of about 20 km, a strong absorption roughly neutral in the considered range of wavelengths (3200-3800 A). This absorption can be explained by the presence of an aerosol layer with very sharp maximum. The altitude of this layer shows some important variations which can be explained by a vertical movement and a latitude effect. In high altitudes an additional absorption, due to ozone, appears for the wavelength 3200 A. Author (ESRO)

N70-16637# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.

SATELLITE OBSERVATIONS OF THE VERTICAL OZONE DISTRIBUTION IN THE UPPER STRATOSPHERE

Gail P. Anderson, Charles A. Barth, Francois Cayla, and Julius London *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 239-243 refs (See N70-16604 05-13)

(Contracts NGL-06-003-052; NAS5-9315; Grant NSF GP-3196)

Avail: CFSTI

An Ebert-Fastie ultraviolet spectrometer mounted onboard a polar-orbiting satellite was used to observe back-scattered radiation in the spectral region 2500-3100 A. A simultaneous set of ozone balloon and rocket observations (Krueger) was used as a calibration for the satellite data. A modified Phillips-Twomey inversion technique was then applied to the data, resulting in a reasonable vertical ozone distribution in the region 35-55 km. Similar results obtained by other methods are in good agreement. Author (ESRO)

N70-16638# Meteorological Research Inst., Tokyo (Japan).

THE POSSIBILITY OF OZONE MEASUREMENTS FROM SATELLITES USING THE 1043 CM SUP MINUS 1 BAND

K. Sekihara and C. D. Walshaw *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 245-253 refs Prepared jointly with Oxford Univ., Clarendon Lab. (See N70-16604 05-13)

Avail: CFSTI

With the aid of numerical calculations of some typical cases, the influence of ozone and temperature profiles on the upward radiation intensities emerging from the atmosphere in five typical spectral regions in the band is discussed. The results are interpreted in terms of the weighting functions w (z) which determine the intensity through the equation I = integral B (z) w (z) dz, where z represents height and B (z) the Planck function of temperature. It is shown that the effect of pressure broadening is to give very similar weighting functions for all five spectral regions, thus offering little prospect of a determination of the ozone profile from satellite radiation measurements. A least squares inversion technique is then briefly described and results for a set of 100 randomly generated ozone profiles and four typical temperature profiles are presented. These temperature profiles are the ARDC standard atmosphere and typical spring profiles for tropical, moderate, and arctic latitudes. Author (ESRO)

N70-16639# Moscow State Univ. (USSR). Dept. of Physics.

DYNAMICS OF THE ATMOSPHERIC OZONE [DYNAMIQUE DE L'OZONE ATMOSPHERIQUE]

A. Khrguian *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 257-261 In FRENCH; ENGLISH summary (See N70-16604 05-13)

Avail: CFSTI

The atmospheric ozone distribution is controlled by photochemical reactions as well as by advection and vertical motions. The former and the latter are connected with the general circulation and with cyclonic disturbances and long waves. The connection is shown by calculations based on the ozone transfer equation, and by the study of the mean ozone distribution and its sudden changes. Their observations may be a significant contribution to the recognition of large scale atmospheric motion. Author (ESRO)

N70-16640# Air Force Cambridge Research Labs., Bedford, Mass.

OZONE, POTENTIAL TEMPERATURE AND ATMOSPHERIC TRANSPORT PROCESSES

Wayne S. Hering *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 275-277 (See N70-16604 05-13)

Avail: CFSTI

Fluctuations in the ozone concentrations of the lower stratosphere are analyzed. It is shown that seasonal distribution of ozone mixing relative to potential temperature surfaces appears to be much the same in both hemispheres. ESRO

N70-16641# Eidgenossische Technische Hochschule, Zurich (Switzerland). Lab. fuer Atmospharenphysik.

MERIDIONAL OZONE TRANSPORT BY TRANSIENT EDDIES OVER BOULDER, COLORADO

H. U. Dutsch and D. Favarger *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 273-281 ref (See N70-16604 05-13)

Avail: CFSTI

The extensive observational material from the Boulder series was used to compute meriodional ozone transport over this place by transient eddies. In agreement with Hering's earlier results for other American stations, it was found that northward transport exists (predominantly in winter) but that it is only appreciable between the tropopause and the 100 mb level. The resulting transport over Boulder was only above one half of the value deduced by Hering from a considerably smaller sample of data. The transport mechanism responsible for the very rapid increase in early winter of ozone at the level of its peak concentration must be of different nature, and it remains to be shown whether it is due to the influence of standing eddies or whether it is effected by a meriodional circulation cell. Author (ESRO)

N70-16642# Swiss Inst. of Meteorology, Zurich.

SYNOPTIC STUDY OF PARTICULAR CASES OF THE HORIZONTAL AND VERTICAL DISTRIBUTIONS OF THE ATMOSPHERIC OZONE [ETUDE SYNOPTIQUE DE CAS PARTICULIERS DE LA DISTRIBUTION HORIZONTALE ET

VERTICALE DE L'OZONE ATMOSPHERIQUE]
Alexandre Piaget *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 285-296 refs In FRENCH; ENGLISH summary (See N70-16604 05-13)
Avail: CFSTI

The ozone soundings made during the period of 6-11 February 1967 on both sides of the Atlantic are compared. They show similar features. From this fact, it is possible to make some assumptions on the changes they were submitted to along their trajectories. The distribution of total ozone amount and of partial pressure of ozone on the 200 mb, 150 mb, and 100 mb surfaces for the 8 February 1967 are shown and discussed. Exchanges between the stratosphere and the troposphere are briefly studied by means of some vertical cross sections. Author (ESRO)

N70-16728# Coast and Geodetic Survey, Rockville, Md.
GRID VALUES OF TOTAL MAGNETIC INTENSITY IGRF-1965
E. B. Fabiano and N. W. Peddie Apr. 1969 58 p
(AD-693878; ESSA-TR-C/G5-38) Avail: SOD $0.60; CFSTI CSCL 8/14

As a result of the combined efforts of various groups within the International Association of Geomagnetism and Aeronomy, an International Geomagnetic Reference Field was agreed upon in October 1968. The IGRF, consisting of 80 spherical harmonic coefficients, provides a common datum suitable for various applications in the analysis of the earths magnetic field such as the removal of trend from detailed geomagnetic surveys. Included in this publication are: Tables of total magnetic intensity (F) and annual change (F) at every 2 degree grid intersection of latitude and longitude for the entire earth, small scale magnetic charts of F and F, and a computer program to derive all the magnetic components and rates of annual change from the IGRF coefficients. Author (TAB)

N70-16740# Naval Oceanographic Office, Washington, D.C.
DISTRIBUTION AND SOME PROBLEMS IN THE ELUCIDATION OF OXYGEN AND PHOSPHATE CONCENTRATION EXTREMES IN PACIFIC OCEAN [RASPREDELENIE I NEKOTORYE VOPROSY VYYAVLENIYA EKSTEMALNYKH KONTSENTRATSII KISLORODA I FOSFATOV V TIKHOM OKEANE]
V. V. Sapozhnikov et al 1969 16 p refs Transl. into ENGLISH from Tr. Inst. Okeanol., Akad. Nauk SSSR (Moscow), v. 83, 1967 p 169-176
(AD-695302; NOO-Trans-452) Avail: CFSTI CSCL 8/10

Methods for estimating oxygen minima and phosphate maxima are described. The main oxygen minimum and phosphate maximum are observed everywhere in the Pacific Ocean. In order to estimate the main oxygen minimum in the ocean it is necessary to use the oxygen-phosphate diagram. Maps showing the distribution of the main oxygen minimum and phosphate maximum have been compiled and their applications are discussed. The results obtained are in agreement with the circulation patterns previously presented. Author (TAB)

N70-16790*# Stanford Research Inst., Menlo Park, Calif.
PREPARATION OF SIMULATED LUNAR SAMPLES Final Report
P. S. DeCarli and R. W. Gates 1 Jan. 1970 15 p
(Contract NAS9-9401; SRI Proj. 7946)
(NASA-CR-102084) Avail: CFSTI CSCL 08G

The development of techniques for shock loading and recovering mineral samples under simulated lunar conditions is described. The mineral samples must be sealed in evacuated containers which are then shocked to sufficiently high pressures to lithify the samples. The containers must remain vacuum tight on release of pressure. In addition, the container must be designed so that it is possible to conduct the operations of loading and sealing the containers and of post-shock opening of the containers with simple tools in a vacuum glove chamber. Three basic sample container systems were designed, tested, modified, and retested. Two of these systems did not yield satisfactory results. The third system worked very well permitting recovery of vacuum tight sample containers after shock loading to pressures as high as 300 kbar. The successful system employs an essentially one-dimensional shock propagation geometry that permits reasonably accurate characterization of the pressure history of the sample. Author

N70-16856# Army Cold Regions Research and Engineering Lab., Hanover, N.J.
DETERMINING THE DYNAMIC PROPERTIES OF SNOW AND ICE BY FORCED VIBRATION
North Smith Jun. 1969 23 p refs
(AD-694376; CRREL-TR-216) Avail: CFSTI CSCL 8/12

The complex dynamic Youngs and shear moduli, loss factor and Poissons ratio are presented for naturally compacted glacial snow through a density range of 0.4 to 0.9 g/cu cm. A frequency dependence of the moduli and its effect on the computation of Poissons ratio is demonstrated. Considerable scatter is exhibited in the loss factor measurements; however, indications are that the loss factors have negligible effect on the modulus computations. Author (TAB)

N70-16864 National Lending Library for Science and Technology, Boston Spa (England).
ON HAZARDOUS CONDITIONS OF ATMOSPHERIC POLLUTION FROM INDUSTRIAL SOURCES
M. E. Berljand [1969] 25 p refs Transl. into ENGLISH from Gl. Geofiz. Observ. (Leningrad), v. 185, 1966 p 15-25 In ENGLISH and RUSSIAN
(NLL-M-7455-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The initial ascent of fumes issuing from chimneys and its dependence upon the coefficient of turbulent exchange and the temperature gradient in the atmosphere is investigated. The conditions are indicated in which the initial ascent of the fumes may be small, in the event of a temperature inversion. In cases in which such conditions are accompanied by small wind speeds, particularly hazardous situations arise, in which the surface concentration of the fumes reaches its highest value. Author

N70-16892# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 217
28 Nov. 1969 96 p refs Transl. into ENGLISH from Russian publs.
(JPRS-49346) Avail: CFSTI

CONTENTS:
1. ASTRONOMY p 1-10 refs (See N70-16893 05-30)
2. METEOROLOGY p 11-25 refs (See N70-16894 05-20)
3. OCEANOGRAPHY p 26-37 refs (See N70-16895 05-13)
4. TERRESTRIAL GEOPHYSICS p 38-42 refs (See N70-16896 05-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 43-88 refs (See N70-16897 05-13)

N70-16895# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 217 28 Nov. 1969 p 26-37 refs (See N70-16892 05-13)
Avail: CFSTI

Theoretical and experimental investigations of ocean motion, composition, and sounding are reviewed. Concentrations of krill in

the Antarctic, petrochemistry of the Romanche Trench, rift zone structure in the Indian Ocean, and sediment composition in the Black Sea, Bering Sea, Indian Ocean, and Pacific Ocean are described. Internal wave formation and the effects of atmospheric pressure on ocean currents are studied. Water temperature measurements from aircraft and noise problems in depth sounding are mentioned, and data from expeditions of research ships are outlined. N.E.N.

N70-16896# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 217 28 Nov. 1969 p 38-42 refs (See N70-16892 05-13)
Avail: CFSTI

Seismic and magnetic sounding methods and instruments are described briefly. The thickness of the earth crust in the Kuril Sea was determined from the dispersion of Love and Rayleigh waves. A new interpretation of deep sounding data which considers forward, refracted, reflected, and diffracted waves is reviewed. The effect of inductive magnetization of samples on the moment of the restitution forces and magnetometer graduation is discussed. News briefs are presented on a quantum magnetometer, a method of selecting seismic waves based on particle displacement, and a method of detecting and recording seismic signals. N.E.N.

N70-16897# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 217 28 Nov. 1969 p 43-88 refs (See N70-16892 05-13)
Avail: CFSTI

Research on the upper atmosphere, space phenomena, spacecraft, and Soviet space flights are briefly reported. Atmospheric circulation, temperature and temperature fluctuations, refraction, ionization space charges, electron dynamics, density, and hydromagnetic waves are covered. Auroras and polar cap absorption are studied. Lunar photograph interpretation and determination of the lunar figure are mentioned. Solar protons, cosmic rays, and Venutian magnetic fields are observed, along with meteor radiants and detection. Spacecraft stability and relative motion, and artificial gravity and magnetic systems are discussed. News briefs are given on unmanned satellites and manned space flights, emphasizing the simultaneous Soyuz 6, 7, and 8 flights. N.E.N.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-15511# Technische Hochschule Munchen (West Germany).
STUDIES ON A DOUBLE CRYSTAL TELESCOPE FOR THE X-RAY REGION [UNTERSUCHUNGEN ZU EINEM DOPPELKRISTALL-TELESKOP IM BEREICH DER ROENTGEN-WELLENLAENGEN]
Wolfgang Maximilian Schmid (Ph.D. Thesis) 2 Jul. 1969 50 p refs In GERMAN
Avail: CFSTI

The described double crystal telescope uses the total reflection region of a single crystal in Bragg reflection to collimate incident radiation. Equations for spatial and spectral resolutions and for light intensity of the telescope are derived and the physical parameters necessary for construction are measured on various combinations of silicon single crystals. Transl. by G.G.

N70-15513# Technische Hochschule Munchen (West Germany).
ULTRARED-MICROKINEMATOGRAPHIC AND RADIOCHEMICAL INVESTIGATION OF PHOTOGRAPHIC DEVELOPMENT [ULTRAROT-MIKROKINEMATOGRAPHISCHE UND RADIOCHEMISCHE UNTERSUCHUNG DER PHOTOGRAPHISCHEN ENTWICKLUNG]
Hans Eger (Ph.D. Thesis) 1969 60 p refs In GERMAN
Avail: CFSTI

Ultrared microscopy was used to study development reactions on single crystals in photographic emulsions based on p-phenylenediamine, glyzine, and hydrochinon at various pH-values and sulfite concentrations. Microkinematic development reactions observed at differing exposure times exhibited pronounced different behavior of the same crystals. The diffusion of a developer substance in a photographic layer was measured by carbon-14 tracer in hydrochinon. It was found that diffusion took place in two steps; the second step, or after-diffusion during silver reduction, was much larger than first initial diffusion. Diffusion measurements established proportionality between developing blackening and developer consumption. Transl. by G.G.

N70-15527# Aerospace Corp., El Segundo, Calif. Electronics Div.
ASPECTS OF PRECISION TIMING SYSTEMS
Warren W. Begley and Arthur H. Shapiro 6 Oct. 1969 118 p refs
(Contract F04701-69-C-0066)
(AD-695458; TOR-0066(5306)-2) Avail: CFSTI CSCL 14/2

Various factors that are pertinent to the implementation and operation of precision timing systems are identified and evaluated. These factors include basic concepts associated with timekeeping, time scales, stable clocks and establishment and maintenance of time synchronization between remotely located clocks. As an example of the application of these factors, the precision timing system recently implemented in the United States Air Force (USAF) Satellite Control Facility (SCF) is described. Author (TAB)

N70-15541# Wilkes Coll., Wilkes-Barre, Pa. Dept. of Physics.
INTERNAL FRICTION IN NON-METALLIC SOLIDS Final Report, Nov. 1966 - Sep. 1968
S. J. Holden, D. P. Detwiler, W. A. Sowa, T. J. Woronowicz, and T. M. Heslin Wright-Patterson AFB, Ohio ARL Jun. 1969 98 p refs
(Contract AF 33(615)-1524)
(AD-694530; ARL-69-0084) Avail: CFSTI CSCL 20/11

An apparatus, which permits routine measurement of internal friction as low as 2 x 10 to the minus 7th power and Youngs modulus as a function of temperature, frequency, and strain amplitude in extremely low loss materials, is presented. The system described herein can be used to investigate a variety of materials and is not hampered by the limitations placed upon composite resonator systems. It has been successfully used to study internal friction in the amplitude-independent and amplitude-dependent regions in pure and CaCl2 doped NaCl. Author (TAB)

N70-15579# Lockheed Missile and Space Co., Sunnyvale, Calif.
INVESTIGATION OF METEORIC MATERIAL ON SPACE VEHICLES BY USING LUMINESCENT TRANSDUCERS
T. N. Nazarova et al 30 May 1969 3 p ref Transl. into ENGLISH from Kosmich. Issled. (Russian), no. 5, 1969 p 795-797
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

Luminescent transducers were used to determine the spatial density and energy characteristics of meteoric particles impact on the Cosmos 213 satellite, and the Zond 5 and Zond 6 space probes. Particle collisions with the luminescent panel caused light flashes to occur which were transformed into electrical signals and amplified by a photomultiplier. Calibrations were made which indicate the dependence of the transducer's electrical signal amplitude

on the velocity, mass, and energy of meteoric particles. Results show that the spatial density of sporadic matter near earth at altitudes greater than 200 km exceeds the density of matter in the Zodiacal cloud by approximately three orders of magnitude. Author

N70-15585# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
A HOLOGRAPHIC SYSTEM FOR LARGE TIME-BANDWIDTH PRODUCT MULTICHANNEL SPECTRAL ANALYSIS
B. J. Pernick and A. Reich Dec. 1969 24 p refs Submitted for publication
(RM-464J) Avail: CFSTI

By recording the output spectral display of a multichannel optical spectrum analyzer as a hologram, a large time bandwidth product system can be achieved. This system preserves the multichannel capability of an optical processor. A system with a time bandwidth product of the order of 10 to the fifth power per channel appears feasible. Author

N70-15605*# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT AND TESTING OF AN IMAGE TUBE CAMERA AND SPECTROGRAPH Final Report
Robert L. Sharpless 1 Sep. 1969 13 p ref
(Contract NASr-4926; SRI Proj. PAU-6376)
(NASA-CR-107586) Avail: CFSTI CSCL 14E

A camera-spectrograph combination in which an image intensifier tube is used for increased light sensitivity is described. This unit was used to observe an artificial aurora generated by a rocket-borne electron accelerator. The trajectory of the rocket departed considerably from the intended trajectory, so that ground observers had no accurate pointing information. Experimental apparatus was misdirected, and no auroral signal was observed. Identification of stars in the field of view shows that stars to a magnitude of 8.6 or below can be detected. This should be sufficient sensitivity to observe auroral rays that fall within the field of view of the camera-spectrograph. Author

N70-15606*# Avco Corp., Tulsa, Okla. Radiation Instrumentation Lab.
CARBON-14 RADIATION DETECTION SYSTEM FOR LIFE DETECTION EXPERIMENTS
Benton C. Clark Nov. 1969 98 p refs
(Contract NAS2-5547)
(NASA-CR-73402) Avail: CFSTI CSCL 11B

A carbon-14 radiation detection system has been developed for use in a science breadboard experiment to demonstrate the feasibility of detecting life on Mars using the carbon dioxide tracer technique. The detection system consists of a spherical proportional counter to measure the beta rays from carbon-14. This counter is built inside a plastic scintillator. The purpose of the scintillator and anti-coincidence circuitry is to reduce sensitivity to background radiation, especially that produced by SNAP-19 units in radioisotope thermoelectric generators (RTG's). Methods of reducing the radiation interference from the RTG's are recommended in terms of location, orientation, shielding, and manufacturing procedures for the SNAP-19. Areas requiring further investigation include the study of a cesium iodide scintillator and a flight qualified photomultiplier tube, design of the system for withstanding all sterilization and mechanical stress environments, and development of countermeasures to the effects of water vapor and electronegative gases upon the operation of the system. Author

N70-15702# Stanford Univ., Calif. High Energy Lab.
SUGGESTED DEVICE FOR PRECISE MEASUREMENT OF PARTICLE TRAJECTORIES
Robert Hofstadter Jul. 1969 16 p refs
(Contract Nonr-225(67); Grant NSF GP-9498)
(AD-695421; SU-HEPL-607) Avail: CFSTI CSCL 18/4

A suggested device for particle detection and measurement is described in which the intersection of a high energy particles trajectory with a detecting plane may be measured with a potential precision of 0.01mm or better. Author (TAB)

N70-15731# Bureau of Mines, Washington, D.C.
AN IMPROVED MAXIMUM-BUBBLE-PRESSURE SYSTEM FOR MEASURING SURFACE TENSION OF MOLTEN METALS
Alfred E. Schwaneke, Wilbert L. Falke, and Vernon R. Miller Jan 1970 13 p refs
(BMRI-7340) Avail: CFSTI

An improved maximum-bubble-pressure system using the Sugden twin-capillary method for measuring the surface tension and density of molten metals is described. Improvements include (1) internally ground capillary tips, (2) electronic pressure transducers, (3) micrometer adjustment of immersion depth for density measurements, (4) valving arrangements to allow operation at other than atmospheric pressure, (5) temperature range to 1,100 C, and (6) recorder readout of pressures. Data for surface tension of mercury from 20 to 300 C are given. Author

N70-15792*# Norton Research Corp. Cambridge, Mass.
A COLD CATHODE ION SOURCE MASS SPECTROMETER EMPLOYING ION COUNTING TECHNIQUES
F. L. Torney, Jr., P. Blum P. Fowler, and J. R. Roehrig Washington NASA Dec. 1969 297 p refs
(Contract NAS1-5347)
(NASA-CR-1475) Avail: CFSTI CSCL 14B

A new type of spectrometer was developed employing a cold cathode source of ions, a quadrupole mass analyzer and an ion counting detector. The instrument is called a cold cathode ion source/quadrupole (CCIS/Quad) mass spectrometer. A detail description is given of all phases of the research and development programs pertaining to the development of the new instrument. Complete construction and assembly drawings of the CCIS are included together with instructions for adapting the source to a commercial analyzer. Instructions are also included for the installation, preparation and operation of the instrument as an UHV residual gas analyzer. Finally, detailed descriptions of the equipment and techniques used to modify the instrument for ion counting detection are included together with the results of a recently completed evaluation of the ion counting detection method. Author

N70-15817# Kyushu Univ. Fukuoka (Japan).
MEASUREMENTS OF SPECIFIC HEATS OF LIQUIDS BY THE USE OF A THERMOS BOTTLE
Tetsu Fujii and Itsuki Morioka *In its* The Rept. of Res. Inst. of Ind. Sci., Kyushu Univ., no. 48 1969 p 1–5 refs In JAPANESE; ENGLISH summary (See N70-15815 05-34)
Avail: CFSTI

An apparatus for measuring specific heats of liquids has been devised. The aim of the apparatus is the measurement of the temperature rise when liquid is electrically heated in a thermos bottle. The heat capacity of the measuring device was determined by calibration with water and ethylene-glycol, and the specific heats of several mineral oils were measured. Author

N70-16143# TELDIX Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germay).
TRANSDUCER SYSTEM TYPE MG 3 FOR A RECOVERABLE SOUNDING ROCKET [MESSWERTGEBERANLAGE MG 3 FUER EINE GEZIELT RUEKFUEHRBARE HOEHENFORSCHUNGSRAKETE]
W. Tetternborn Munich Bundesministerium fuer Wiss. Forsch. Aug. 1969 55 p refs In GERMAN; ENGLISH summary
(BMwF-FB-W-69-34) Avail: CFSTI

A design description is given of the TELDIX transducer

system type MG 3 for a recoverable sounding rocket, as well as results of the tests conducted on the prototype of the system. After a description of the theory of operation of the system, the sensors and electronic circuits are described. A brief description of the dummy and the test desk is followed by a discussion of the results of the tests conducted on the transducer system, including environmental and integrational tests within the overall system.
Author (ESRO)

N70-16169# National Center for Atmospheric Research, Boulder, Colo.
THERMAL ANALYSIS OF BALLOON-BORNE INSTRUMENT PACKAGES
Frank Kreith and John C. Warren Jan. 1970 30 p refs Sponsored by NSF
(NCAR-TN-45) Avail: Issuing Activity

An analytical method was developed for predicting the temperature of an instrument package at 70,000 ft. altitude. A comparison of the effectiveness of aluminum and Mylar-aluminum laminate as package covering at high altitudes was made. Analytical and tests results were compared for balloon-borne instrument packages.
Author

N70-16208# International Harvester Co., Chicago, Ill.
ULTRASONIC TEST PROCEDURE FOR RATING INTERNAL CLEANLINESS OF SEMI-FINISHED MATERIAL Final Report, 17 Jun. 1968 - 16 Jun. 1969
C. L. Carter, R. A. Cellitti, and J. W. Abar Jun. 1969 123 p
(Contract DAAG46-68-C-0008)
(AD-695680; AMMRC-CR-69-11) Avail: CFSTI CSCL 11/6

An investigation was conducted to evaluate and standardize upon various ultrasonic instrument and operational parameters which may alter inspectional response in the detection of nonmetallic inclusions and cleanliness rating of semi-finished material. In order to obtain an acceptable degree of uniformity of test results between various laboratories, recommendations are presented with regard to specimen preparation, instrumentation requirements, search unit specifications, system calibration, inspection procedure and data processing.
Author (TAB)

N70-16214*# Motorola Inc., Scottsdale, Ariz. Advanced Development Section.
AROD GEODETIC FEASIBILITY ANALYSIS PROGRAM Final Report
Stanley W. Attwood 26 Nov. 1969 198 p refs
(Contract NASw-1794)
(NASA-CR-107917) Avail: CFSTI CSCL 14B

The potential performance of AROD as a satellite geodetic survey instrument was evaluated. This analysis reviews four principle areas: (1) equipment performance, (2) propagation effects, (3) geometrical effects, and (4) the benefits of advanced data processing. The main results of the study are that the ranging capability of the AROD System and advanced methods of propagation correction largely remove ranging error from geodetic survey. The principle source of error is the definition of orbital parameters and strength of figures. Geodetic survey to accuracies of 1 meter are possible with a relatively few number of passes.
Author

N70-16216*# California Univ., Berkeley. Space Sciences Lab.
COMPLETE FABRICATION OF ROCKET PAYLOAD HARDWARE Final Report
C. Stuart Bowyer and Michael Lampton 1 Dec. 1969 52 p refs
(Contract NSR-05-003-287)
(NASA-CR-107725) Avail: CFSTI CSCL 14B

The development of an Aerobee payload and other instrumentation for studies in galactic X-ray astronomy is described. The instrumentation developed through launch are: (1) an Aerobee instrumentation package for galactic X-ray astronomy; (2) an instrument designed to carry out galactic X-ray astronomy from a balloon; and (3) a far UV photometer for use in the wavelength band from 100 to 1000 A. This instrument was employed in a search for XUV resonant radiation in the earths geocorona and a search for XUV radiation from objects in the night sky. In addition, as work on this instrumentation progressed it became clear that it provided a powerful tool for analyzing planetary atmospheres. This instrument was proposed for a Flyby to Jupiter and a Flyby to Venus/Mercury.
Author

N70-16246# International Business Machines Corp., Owego, N.Y.
A STUDY OF RAPID PHOTOINTERPRETATION METHODS
R. L. Beechler, S. H. Winterstein, R. M. Kamper, and T. E. Jeffrey (Army Behavioral Sci. Res. Lab.) Jun. 1969 73 p
(Contract DA-49-092-ARO-44)
(AD-694348; BESRL-TRR-1153) Avail: CFSTI CSCL 14/5

The study was designed to assess the value of single-phase and two-phase methods of quick-time image interpretation. Accuracy and completeness data were compared for single-phase (one viewing of each photo frame) and two-phase (first and second viewings of each frame) interpretation methods. With the two-phase methods, results when the same interpreter accomplished both phases were compared with results when a different interpreter accomplished each phase. Each of the 64 experienced interpreters participating in the experiment was designated as above or below the median of the interpreter group on the basis of independent ratings by two supervisors. Screening of target frames averaged 90 percent correct over all conditions.
Author (TAB)

N70-16350*# HH Controls Co., Inc., Arlington, Mass.
PRECISION SENSOR ALIGNMENT Final
Harold H. Seward Dec. 1969 11 p
(Contract NAS12-2056)
(NASA-CR-86307) Avail: CFSTI CSCL 14B

In applying the model 300-50 wideband autocollimator system to a Carco three-axis test-table determination of the suitability of an arrangement for the testing of a precision ultraviolet horizon sensor was made. The UV-horizon sensor was mounted onto the Carco test platform along with two mirror flats which were used for the autocollimator systems. The autocollimators and a horizon-simulator were mounted to the laboratory floor adjacent to the Carco table and the test system was dynamically and statically observed to evaluate its performance for sensor testing.
Author

N70-16376# Harry Diamond Labs., Washington, D.C.
ANALYSIS OF UNFOLDING GAMMA RAY SPECTRA MEASURED BY COMPTON-DIODE DETECTORS
Donald E. Wortman, Clyde A. Morrison, and Nick Karayianis Jul. 1969 37 p refs Sponsored by DASA
(AD-695646; HDL-TR-1454) Avail: CFSTI CSCL 18/4

Several of the methods that might be used in constructing a gamma-ray spectrum as measured by a finite number of detectors are compared in this work. Particular emphasis is placed on determining how well an incident spectrum can be represented by measurements taken with five Compton-diode detectors arranged in tandem. Several numerical examples are given illustrating that many methods devised to approximate the incident spectrum can yield erroneous results. These numerical calculations indicate the advantages of a method presented earlier over other methods in determining an unknown gamma-ray spectrum. These examples substantiate this earlier work in showing that probably the best representation of the unknown spectrum can be obtained by expanding the spectrum in terms of the response functions of the system. Any component of the incident spectrum that is orthogonal to all the response functions will not contribute to the output; hence such a component of the spectrum would not be detected by the measuring device. In this sense, the solution contains all the information about the unknown spectrum that the measurements are capable of giving. An analytic form for the response functions of the Compton diodes which were previously determined by Monte Carlo calculations at discrete energy points is also given.
Author (TAB)

N70-16400*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Div.
MICROWAVE INSPECTION APPLICATIONS GUIDE
[1969] 135 p refs
(Contracts NAS7-367; NAS7-544)
(NASA-CR-107670) Avail: CFSTI CSCL 14B

This guide describes the Frequency Domain Interferometer (FDI) as developed. This applications guide contains descriptions of the equipment and techniques which were successful enough to be recommended to the nondestructive test engineer as practical solutions to his inspection problems. A mathematical analysis of the FDI signal analyzer operation is presented in the appendix. With this exception, the theory is kept as simple as is possible. No particular familiarity with microwave technology is really required, although the user will no doubt desire some understanding of the operation of the basic waveguide components. Author

N70-16402*# National Aeronautics and Space Administration, Washington, D.C.
THE INTERNATIONAL SYSTEM OF UNITS: PHYSICAL CONSTANTS AND CONVERSION FACTORS
E. A. Mechtly (Illinois Univ., Urbana) 1969 22 p refs Revised
(NASA-SP-7012) Avail: SOD $0.30; CFSTI CSCL 14B

Defined is the international system of units adopted by thirty-six countries including the United States. This coherent system is based on the meter, kilogram, second, ampere, kelvin, and candela. Included are tables of numerical factors for conversion from miscellaneous units to above described standards. G.G.

N70-16407*# Michigan Univ., Ann Arbor. Infrared and Optics Lab.
FURTHER INFRARED SYSTEMS STUDIES FOR THE EARTH RESOURCES PROGRAM Final Report
J. Braithwaite, L. Larsen, and E. Work Dec. 1969 77 p refs
(Contract NAS9-8381)
(NASA-CR-102111; WRL-2122-14-F) Avail: CFSTI CSCL 14B

This report discusses the development of design concepts and specifications for multispectral scanners for use from orbit as part of the Earth Resources Program. The performance of such scanners may be limited by component performance, by weight and power allocations, and by the data rates and bulks which can be returned to the ground. Some of the more critical of these factors have been examined in detail, and methods of dealing with them have been investigated. It is shown, for example, that a 7-channel scanner with a 200 ft ground resolution is feasible, but that the swath width would be limited to less than 20 miles unless telemetry bandwidths larger than those in current use are made available. Author

N70-16424*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
STUDY OF AN ASYNCHRONOUS LOW DISCHARGE FLOW METER [ISSLEDOVANIYE ASINKHRONNOGO RASKHODOMERA MALYKH RASKHODOV]
N. V. Yalovega Washington NASA Jan. 1970 7 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (Moscow), v. 7, no. 4, 1969 p 806–809
(Contract NASw-1692)
(NASA-TT-F-12771) Avail: CFSTI CSCL 14B

A system for non-contact measurement of low flow rates of liquid metals using two transformer converters is described. Changes in physical parameters along an elliptical channel in the vicinity of the exciter and sensors are plotted. Author

N70-16485# Westinghouse Electric Corp., Pittsburgh, Pa.
DEVELOPMENT OF A BORON CONCENTRATION METER Final Report
J. E. Bulkowski, W. D. Fletcher, A. G. Opitz, V. Rajagopal, and D. D. White Apr. 1969 188 p refs Sponsored jointly with EURATOM
(Contract AT(30-1)-3690)
(WCAP-3690-7; EURAEC-2094) Avail: CFSTI

Two prototype meters for monitoring reactor coolant boron concentration were developed and evaluated. One meter employs the mannitol-conductance technique for determining boron concentration; the other employs the neutron-absorption technique. Both meters are capable of quickly determining boron concentration in the reactor coolant, and both may be operated continuously, if desired. The development, operation, evaluation of the prototype meters, and a description of each meter are summarized. Author (NSA)

N70-16499# Stanford Univ., Calif. Dept. of Mechanical Engineering.
A NEW DIMENSION IN HYDRAULIC MACHINERY TESTING WITH THE QUARTZ CRYSTAL THERMOMETER
A. L. London and D. V. Nelson Aug. 1969 58 p
(Contract Nonr-225(91))
(AD-695400; TR-72) Avail: CFSTI CSCL 13/11

The development of the quartz crystal thermometer with high sensitivity and good stability has added a new dimension to the test evaluation of hydraulic machinery performance. Hydraulic losses appear as a heating effect in the fluid, and these small temperature increases can be detected with uncertainties of the order of 1 ft of head loss. The report presents the theory used in the hydrothermal method of testing and demonstrates its application in a particular pump test. The techniques used to properly average fluid temperature at a flow cross-section are described. The values of pump efficiency established by the conventional hydromechanical tests and those established by the hydrothermal measurements for eight tests had an average difference of 0.8 percentage points. This difference is well within experimental uncertainty. Author (TAB)

N70-16521# European Organization for Nuclear Research, Geneva (Switzerland).
EMITTANCE MEASUREMENT AT THE CERN PS LINAC WITH AN ON-LINE COMPUTER
U. Tellgren, U. Kracht, A. van der Schueren *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 168–174 refs (See N70-16501 05-24)
Avail: CFSTI

The emittance measurement equipment at the CERN PS Linac has been connected to an on-line computer (IBM 1800). Four digitalized parameter values, six limit numbers and a status word are fed over a fast multiplexer system 200 m to the computer. The advancement of the measurement gear is under control of the computer. A typewriter at the linac gives a line by line print-out of elementary emittance currents giving by their positions on the print-out the shape of the phase space area and the current distribution inside it. Ten error conditions can at present be recognized by the computer program. Error messages are displayed on a TV-monitor or printed out on the typewriter. Advantages gained from the on-line operation with the computer are less operator fatigue and possibility to follow immediately the evolution of the measurement. Author (NSA)

N70-16522# Los Alamos Scientific Lab., N.Mex.
A REAL-TIME SAMPLING BEAM POSITION MONITOR
J. M. Potter *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 175–189 Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

By using a real time sampling system, beam position vs. time was determined for long pulses without long circuit time constants and expensive matched signal channels. The magnetic field, resulting from an RF current inside a conducting cylinder, was found by considering a corresponding magnetostatic problem. Relative beam position measurements were determined. The amplitude factor, relating induced emf to the field at the wall, took into account the beam and wave velocities induced on the loop.

Detailed circuit design is reviewed including beam position sampling, monitor loop, gated mixers, logarithmic IF amplifier, demultiplexer, and time base generator. Beam position monitor system was bench-tested using an RF current or a wire to simulate the beam, and one unit was tried out on the 1.5 MeV beam from Model M, the EPA injector. Results indicate that the system has no gross nonlinearities or x–y coupling. J.A.M.

N70-16523# Argonne National Lab., Ill.
A NONDESTRUCTIVE LINAC BEAM DENSITY PROFILE MONITOR
William H. De Luca and Michael F. Shea *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 190–197 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

Properties of the beam, emerging from proton linear accelerators, are normally measured with the aid of destructive diagnostic equipment such as slits and Faraday cups. A nondestructive beam density profile monitor which has been designed and built for use in the Argonne National Laboratory 50 MeV proton lines is described. Author (NSA)

N70-16597# Akademiya Nauk URSR, Kiev.
THERMOGRADIENT MEASUREMENTS IN DEEP BOREHOLES
A. N. Shcherban and N. I. Furman *In its* Mining Thermophysics 1968 p 85–92 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

A geogradient temperature gage is described for direct measurement of the sum and difference of temperatures at two points, selected arbitrarily along the depth of a borehole. The dynamic properties of the device are analyzed and a nomogram is given for calculating temperatures at the dislocation points of the temperature-sensitive elements from the measured values of their sum and difference. Transl. by R.B.

N70-16598# Akademiya Nauk URSR, Kiev.
REMOTE MEASUREMENT OF THE TEMPERATURE OF THE FLUSHING LIQUID DURING DRILLING OF DEEP WELLS
N. I. Furman, V. P Chernyak, N. S. Belogolovin, V. N. Tarasevich, and V. G. Grishko *In its* Mining Thermophysics 1968 p 93–100 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

A design-schematic solution is presented of a two-wire depth-thermometer for separate telemetric measurement of the absolute temperatures of the flushing liquid when sinking deep wells in direct proximity to the face. The measuring block of the device, including its telemetric section, is standard and may be used without additional modifications for simultaneous discrete interrogation of information from other thermophysical control elements in the well. Transl. by R.B.

N70-16606# Meteorological Office (Gt. Brit.)
AN IMPROVED SOLID STATE AMPLIFIER FOR THE DOBSON OZONE SPECTROPHOTOMETER
C. V. Else, D. B. B. Powell, and E. L. Simmons *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 53–55 (See N70-16604 05-13)
Avail: CFSTI

The amplifier is designed to work in conjunction with a solid state phase sensitive detector, which replaces the existing commutator. The phase reference is provided by a lamp and phototransistor unit which is substituted for the commutator. Sufficient output is provided to drive a robust micronometer, which is fully protected against overloads. The amplifier itself uses two commercial operational amplifiers, the first of which is very flatly tuned between 76 and 80 Hz. The unit also includes a compact non-lethal EHT inverter, so that no external equipment is needed. Author (ESRO)

N70-16607# Meteorological Service of Canada, Ottawa (Ontario).
A PERISCOPE FOR THE DOBSON SPECTROPHOTOMETER
R. A. Olafson *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 57–58 (See N70-16604 05-13)
Avail: CFSTI

A description is given of a periscope used to facilitate observations with the Dobson spectrophotometer in the Arctic regions. ESRO

N70-16608# Meteorological Service of Canada, Ottawa (Ontario).
A TWO LAMP OPTICAL WEDGE CALIBRATOR
R. A. Olafson *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 59–60 (See N70-16604 05-13)
Avail: CFSTI

The two lamp calibration method for the Dobson spectrophotometer was found to be unstable since the lamps do not settle down quickly nor reproducibly. A new arrangement was designed in which the lamps are enclosed in a housing and are operated continuously, the switching being accomplished by means of a shutter. ESRO

N70-16609# Meteorological Service of Canada, Ottawa (Ontario).
ACCEPTANCE CONE OF THE DOBSON SPECTROPHOTOMETER
R. A. Olafson *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 61–62 (See N70-16604 05-13)
Avail: CFSTI

Use of Dobson ozone spectrophotometers has given rise to this discussion of the direction of and the power response in their acceptance cones. ESRO

N70-16611# Meteorological Service of Canada, Ottawa (Ontario).
A TRANSISTOR PHOTOMULTIPLIER POWER SUPPLY
R. A. Olafson *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 65 (See N70-16604 05-13)
Avail: CFSTI

A small DC to DC converter was developed with a 1200 volt regulated output to feed a photomultiplier tube. ESRO

N70-16625# Meteorological Office (Gt. Brit.)
SOME LABORATORY AND FIELD INVESTIGATIONS OF THE ACCURACY OF BREWER-MAST OZONE SENSORS
D. B. B. Powell and E. L. Simmons *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 143–147 refs (See N70-16604 05-13)
Avail: CFSTI

An attempt is made at discovering the reason for the persistent difference between the integrated amount of ozone obtained in ozone soundings and the total ozone measured by the Dobson ozone spectrophotometer, and for the variations in this difference. In the laboratory, ozone and air are admitted to a bell-jar which can be pumped down to pressures of 5 mb. The rate of flow of a rich ozone-oxygen mixture into the bell-jar is kept constant while the amount of air is adjusted to keep the partial pressure roughly constant. Larger variations of sensitivity are found than can be explained by the changes in the pumping rate which is measured in a separate experiment. Experimental soundings are presented in which Brewer-Mast and Komhyr ozone sensors are flown together, and in which two Brewer-Mast sensors are connected in cascade in one sonde and telemetered separately. Author (ESRO)

N70-16626# Environmental Sciences Services Administration, Boulder, Colo. Research Lab.
ELECTROCHEMICAL CONCENTRATION CELLS FOR GAS ANALYSIS
W. D. Komhyr *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 149–156 refs Presented at the 9th Methods Conf. in Air Pollution and Ind. Hyg. Studies, Pasadena, Calif., 7–9 Feb. 1968 (See N70-16604 05-13)

Avail: CFSTI

Several varieties of an iodine/iodide redox electrode concentration cell are described that are useful for monitoring selected atmospheric oxidants and reductants, e.g. ozone and sulfur dioxide at concentrations down to one part per billion. The basic cell is similar to that described by Gluckauf et al (1944) in that it is comprised of two bright platinum electrodes immersed in potassium iodide solutions. Unlike the Gluckauf cell, however, to which an external potential of about 0.15 V must be applied, the new cell derives its driving emf from a difference in electrolyte concentrations surrounding its cathode and anode. The cells were successfully employed to measure the vertical distribution of atmospheric ozone, and were used for monitoring near ground-level ozone and sulfur dioxide. Author (ESRO)

N70-16627# Etablissement d'Etudes et de Recherches Meteorologiques, Paris (France).

OZONE OPTICAL SONDE FOR SIMULTANEOUS MEASUREMENTS [SONDE OPTIQUE D'OZONE A MESURES SIMULTANEES]

G. Froment *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 159-164 refs In FRENCH; ENGLISH summary (See N70-16604 05-13)

Avail: CFSTI

Two requirements of the optical method are emphasized: the accuracy needed by the differential principle, and automatization of the data processing from a practical point of view. A detailed technical description of a sonde designed to fulfill both requirements is given and the validity of the chosen model is considered with the help of some results. Author (ESRO)

N70-16673# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.

IMAGE FORMATION IN THE PHILIPS EM-300: AS APPLIED TO ELECTRON DIFFRACTION CONTRAST EXPERIMENTS

A. K. Eikum Feb. 1969 31 p refs

(AD-694305; DI-82-0825) Avail: CFSTI CSCL 14/2

This paper illustrates some geometrical considerations related to image formation in the electron microscope, how the sense of the specimen tilt can be defined and applied to electron diffraction contrast experiments. The discussion is based upon the Philips EM-300, however, the use of diffraction patterns to define the sense of specimen tilt is generally applicable. The potential of stereomicroscopy as an aid to the analysis of contrast results is discussed briefly. Author (TAB)

N70-16707*# Research Triangle Inst., Durham, N.C.

GEODETIC SATELLITE ALTIMETER STUDY: A REVIEW OF ELECTROMAGNETIC SCATTERING FROM THE OCEAN SURFACE

Sep. 1969 23 p refs

(Contract NASw-1909)

(NASA-CR-107746) Avail: CFSTI CSCL 14B

The theory of scattering of electromagnetic waves by the sea surface as it is relevant to the design of a geodetic satellite altimeter is reviewed. The specific problem considered is the dependence of backscattered radar energy on the characteristics of the sea surface. It is found that excellent agreement exists between the various theories for normal incidence geometry. For appreciable angles away from normal incidence, the problem greatly increases in complexity. When the radius of curvature of the ocean surface is large compared to the illuminating wavelength and when the surface height statistics are normally distributed, the backscattered power is given by an integral containing the surface correlation function and the ratio of the rms (sea) wave height to the radar wavelength. If it is assumed that the surface correlation function is isotropic and that the ratio of the (ocean) wave height to radar wavelength is very large, the integral is evaluated to show that the backscattered power at normal incidence is inversely proportional to the mean square slope of the sea surface. Author

N70-16750# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

DRIVING PERFORMANCES WITH INFRARED PERISCOPES IN MONOCULAR, BI-OCULAR AND BINOCULAR VIEWING CONDITIONS [RIJPRESTATIES MET INFRAROOD RIJPERISCOPEN BIJ MONOCULAIRE, BI-OCULAIRE EN BINOCULAIRE WAARNEMING]

J. Walraven and J. Varkevisser 1969 26 p refs In DUTCH; ENGLISH summary

(IZF-1969-18; TDCK-54371) Avail: CFSTI

Infrared driving periscopes - or image intensifiers - may differ with respect to the mode of vision employed. One can discern monocular, biocular (pseudobinocular) and binocular periscopes; with the binocular periscope stereoscopic depth perception is possible in principle. In order to establish whether these differences in viewing conditions might lead to differences in driving performance, experiments were carried out in which a binocular and pseudobinocular periscope were tested under binocular as well as monocular viewing conditions. Similar experiments were performed with the unaided eye. It can be shown that stereoscopic vision does not contribute to a better driving performance. However driving performance is slightly better with (pseudo) binocular vision as compared to monocular viewing (ca. 5%), possibly as a consequence of the asymmetric loading of the visual system with monocular vision. Results from a pilot experiment suggest that magnification and, more important, image distortion have been responsible for the relatively poor driving performance with the binocular periscope. Author

N70-16857# United States Lake Survey, Detroit, Mich. Hydrographic Branch.

EXPERIMENTAL TECHNIQUES FOR LEVELS OF HIGH PRECISION USING THE ZEISS Ni 2 AUTOMATIC LEVEL Final Report

Ralph Moore Berry (Michigan Univ., Ann Arbor) Jul. 1969 28 p refs

(AD-693804; MP-69-4) Avail: CFSTI CSCL 8/5

Instrumentation and Techniques developed by the U. S. Lake Survey for levels of high precision are described. Automatic or self-leveling Zeiss Ni2 instrument is used with plane-parallel plate micrometer. Special techniques are used to compensate for systematic errors unique to automatic levels. Levels can be run with these methods to a tolerance of 1.5 millimeters times the square root of the length of the section in kilometers. Author (TAB)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-15535# Boeing Scientific Research Labs., Seattle, Wash.

CORROSION OF SERVO VALVES BY AN ELECTROKINETIC STREAMING CURRENT

T. R. Beck, D. W. Mahaffey, and J. H. Olsen Sep. 1969 143 p refs

(AD-695492; D1-82-0839) Avail: CFSTI CSCL 13/11

Corrosion driven by electrokinetic currents was found to be responsible for damage to steel servo valves operating in phosphate ester fluids. Calculations and test results supporting this conclusion and measurements of the electrokinetic and electrochemical properties of the steel to fluid interface are described. Possible fluid additives for reducing the damage are discussed. Author (TAB)

N70-15544*# Techtran Corp., Glen Burnie, Md.
STABILITY OF HIGH SPEED ROTORS WITH SLIDING BEARINGS [PROBLEMA USTOICHIVOSTI BYSTROKHODNYKH ROTOROV S OPORAMI SKOL'ZHENIIA]
S. I. Sergeev Washington NASA Dec. 1969 18 p refs Transl. into ENGLISH from the book Apparaty i Mashiny Kislorodnykh i Kriogennykh Ustanovok Moscow, Mashinostroeniy, 1968 p 156–171
(Contract NASw-1695)
(NASA-TT-F-12718) Avail: CFSTI CSCL 13I

Unresolved problems, associated with the more general stability problem of rotor rotation, in the hydrodynamics of the lubrication layer in sliding bearings are discussed. A comparative analysis of experience obtained with bearings and shock absorbers with a discontinuous viscous fluid film reveals some substantial deficiences of the methods currently used for determining hydromechanical forces. Criteria defining rotor stability are examined, showing that the large number of the principal and derived criteria commonly employed inhibit to a great extent the processing of the extensive experimental data now available. Some recommendations concerning rotor stabilization are included. Author

N70-15595# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
PERMANENT HIGH TEMPERATURE VACUUM TUBING JOINTS
J. W. Patten Aug. 1969 15 p refs
(AD-695493; D1-82-0889) Avail: CFSTI CSCL 13/5

A new method has been developed for producing permanent tube joints exhibiting decreasing leak rate with increasing service temperature. This allows leak testing of vacuum connections at room temperature with the confidence that leak rates will not increase at elevated temperatures. A uniform internal cross-sectional area and smooth outer surfaces may also be readily provided. The process involves diffusion bonding of dissimilar metal sealing surfaces and lends itself to such problem materials as titanium and zirconium alloys. Splices and joints to dissimilar metal tubes, elbow, valves, and other fittings may be fabricated easily and reliably. Dimensional tolerances become less critical with increasing tube diameter. Joint strength is limited by the strength of the base metals. Experimental procedures for joint design, assembly, and testing are reported. Author (TAB)

N70-15716 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.
PRINCIPAL ELECTRODE PARAMETERS DETERMINING THE DEGREE OF CHEMICAL MACRO-HETEROGENEITY IN WELD METAL IN ALLOYING THROUGH A COATING
A. A. Erokhin et al Jun. 1969 17 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 1, 1969 p 54–61 in RUSSIAN and ENGLISH
(NLL-Trans-746-174-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL Photocopy Coupons

An examination is made of the conditions of uniform distribution of alloying elements in weld metal during alloying through a coating. The concept is introduced of an effective coating layer representing some fraction epsilon of the coating thickness. The dependence is established of epsilon on the amount of an alloying addition, M, in the coating charge and on its melting temperature T sub s. It is demonstrated that epsilon is related to the chemical heterogeneity and mechanical properties of weld metal. Author

N70-15838# Oak Ridge National Lab., Tenn. Plant and Equipment Div.
DESIGN AND EVALUATION OF A LABORATORY COLD ROLLING MILL
James R. Gibson (M.S. Thesis - Tenn. Univ.) Oct. 1969 73 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2625) Avail: CFSTI

Design and evaluation of a laboratory cold rolling mill which is used to produce thin foils of all types of metal isotopes is reported. The mill design is based on requirements for rolling sheets of stainless steel to a specified thickness and uniformity. Emphasis is on operation of the backup rolls and work rolls with particular attention to deflection and stress distribution under maximum expected rolling load. The backup rolls are treated as simply supported beams under a uniformly distributed load. The work rolls are supported by the backup rolls and are set at a small diameter so as to reduce the separating force developed during reduction of the workpiece. The design of the remainder of the rolling mill components is based on the separating force developed at the work rolls. The evaluation of the rolling mill was performed by rolling several sample sheets of stainless steel to the final required thickess under the condition of maximum reduction. Author (NSA)

N70-15963 Burroughs Corp., Detroit, Mich.
ZERO REJECT PROGRAM ON PRECISION INJECTION MOLDED BOBBIN FOR BURROUGHS COMPUTERS
Nami Hazneci *In* Soc. of Plastic Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 20–23 (See N70-15959 05-18)
Copyright. Avail: Issuing Activity

Problems involved with a rectagular-core bobbin measuring 0.425 inches at its greatest dimesion, with 0.011-inch wall thickness and 0.020-inch flange thickness, are briefly treated. The successful application of a glass sphere-filled nylon material to reduce the rejection rate of the bobbin, whose dimensional accuracy is critical and whose performance characteristics cannot tolerate so much as a 0.001-inch flash, is described. A.C.R.

N70-16153# Netherlands Research Centre TNO for Shipbuilding and Navigation, Delft. Engineering Dept.
TORSIONAL-AXIAL VIBRATIONS OF SHIP'S PROPULSION SYSTEM. PART 2: THEORETICAL ANALYSIS OF THE AXIAL STIFFNESS OF THE SHAFT SUPPORT AT THE THRUSTBLOCK LOCATION [TORSIE-AXIAAL TRILLINGEN IN EEN SCHEEPSVOORTSTUWINGSSYSTEEM. DEEL 2: THEORETISCHE ANALYSE VAN DE STUFHEID IN AXIALE RICHTING VA DE ASONDERSTEUNING TER PLAATSE VAN HET STUWBLOK]
W. Van Gent and S. Hylarides Oct. 1969 20 p refs
(Rept-132M-Pt-2) Avail: Issuing Activity

The effective dynamic stiffness experienced in axial direction by the propeller shaft in the thrustblock has been analysed. The hydrodynamical rigidity of the oil film is derived from the dynamical behaviour of the thrustblock for small variations round equilibrium, which derivation is based on the pressure distribution equation for the viscous flow in a narrow slot. The structural stiffness has been obtained by means of the finite element technique; only static calculations have been performed. In conclusion a qualitative picture is built up of the composition of the effective stiffness. The calculated value comes close to the experimentally obtained value. Author

N70-16154 Netherlands Research Centre for Shipbuilding and Navigation, Delft. Shipbuilding Dept.
RESIDUAL FUEL TREATMENT ON BOARD SHIP. PART 3: COMPARATIVE SHIPBOARD MEASUREMENTS OF CYLINDER LINER AND PISTON RING WEAR ON MAIN ENGINES USING FILTERED OR CENTRIFUGED RESIDUAL FUEL
A. De Mooy, P. J. Bradenburg and G. G. Van Der Meulen Sep. 1969 21 p refs
(Rept-129-M) Copyright. Avail: Issuing Activity

To investigate the effect of two residual fuel pruification methods comparative cylinder liner and piston ring wear measurements

were carried out on the main engines of two different ships, under normal operating conditions during several voyages. The results indicate that the wear rate of the engines did not differ significantly for the fuel treatments used. Author

N70-16188# Frankford Arsenal, Philadelphia, Pa. Pitmann-Dunn Research Labs.
EXPLOSION WELDING OF CYLINDRICAL SHAPE
Harry J. Addison, Jr., James F. Kowalick, and Winston W. Cavell May 1969 27 p refs
(AD-694359; A69-3) Avail: CFSTI CSCL 13/8

A number of papers have been published in the open literature on the explosion welding of concentric cylinders and on the joining of tubes to tubeplates. The paper attempts to provide a concise review of these contributions by discussing work performed by the authors and other investigators. Basically, two explosion welding techniques have been employed to weld cylindrical members. These are the gap technique in which the walls of the members are positioned parallel to each other, and the angular technique in which the walls are inclined at an angle. In the present stage of process development, concentric cylinders generally are welded using the gap technique. Welding conditions and difficulties characteristic of the process are discussed. Much of the available data on the explosion welding of cylindrical configurations relate to the joining of tubes to tubeplates. Both angular and gap techniques have been used for these applications. Advantages and disadvantages of these techniques are considered and a number of shortcomings that have been encountered are discussed. Various base metal combinations that have been used in explosively welded cylindrical specimens and tubes to tubeplate are reported. Author (TAB)

N70-16247# Massachusetts Inst. of Tech., Cambridge. Dept. of Naval Architecture and Marine Engineering.
INVESTIGATION OF DISTORTION REMOVAL IN WELDED STRUCTURES Final Report
Koichi Masubuchi and R. A. Walsh 15 Sep. 1969 24 p Sponsored by US Coast Guard
(AD-695502) Avail: CFSTI CSCL 13/10

System models were constructed of mild steel and HY-80 steel plates to approximate plate and stiffener construction in ship fabrication. Flame heating temperature and point of application were varied in the experiments. Welding procedures, water quench rate and flame heating processes were maintained constant. In this study it was shown that flame straightening of HY-80 Steel Structures is less effective in reducing weld distortion, whereas, for mild steel the process is effective. Also, varying the point of heat application has varying effects on the amount of distortion removal. Author (TAB)

N70-16404*# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
COMPRESSION SPRINGS FOR LONG TIME OPERATION IN VACUUM AT 1000 F
A. H. Powell [1969] 68 p refs
(Contract NAS3-9421)
(NASA-CR-107740; GESP-345) Avail: CFSTI CSCL 13I

Electrical switchgear for large space power systems operating in a temperature environment of 1000 F require various springs that must operate reliably for long periods. Suitable materials are quite limited, and designs must be conservative, to obtain low relaxation. An extensive investigation of possible materials and design parameters led to the selection of Inconel 718 with triple heat treat, for opening and contact wipe springs. Tests over a 2000 hour period at 1000 F showed low relaxation and good performance. Author

N70-16410* Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
AUTOMOTIVE TIRES: CONSTRUCTION, DESIGN, TESTING, AND OPERATION
V. L. Biderman et al Washington NASA Sep. 1969 246 p refs Transl. into ENGLISH from the book 'Avtomob. Shiny Konstrukt., Raschet, Ispytaniye, Ekspluatatsiya' Moscow, State Sci. and Tech. Press for Chem. Lit., 1963 p 1-171 p 291-383
(Contract NASw-1692)
(NASA-TT-F-12382) Avail: CFSTI CSCL 13F

An assessment of automobile tire technology is presented including discussions on the development and theory of pneumatic tires, rubberized cord construction and internal pressurization, operating characteristics of tires, and methods of testing and servicing tires.

N70-16481# Factory Mutual Research Corp., Norwood, Mass.
CONTROL AND REDUCTION OF OIL MISTS FROM MECHANICAL VACUUM PUMPS
R. D. Edwards, P. E. Johnson, and C. Yao 1969 29 p refs
(TID-25085) Avail: CFSTI

Oil mists exhausted from mechanical vacuum pumps into glovebox exhaust systems can clog or violate high efficiency exhaust filters, and deposit oil film in duct-work that presents a fire hazard. A research project was undertaken to develop a means of mist control. The causes and characteristics of oil mist formation were examined. Three methods of resolving the problem were investigated: simple modification of existing pumps, substitution of silicone oils for conventional pump oils, and collection and removal of oil mists from pump exhaust lines. It was concluded that, within the scope of methods investigated, mist formation could not be prevented, and that some method of mist control would be needed. Several types of mist collectors were evaluated. Depending on the capacity of the pump and its appliation, a York demister, a Pall cartridge filter, or a high efficiency air filter, in the exhaust line of mechanical pumps, are recommended for collecting oil mists. Recommendations are also made on the arrangement of mist collectors for safe, efficient operation. Author (NSA)

N70-16592# Akademiya Nauk URSR, Kiev.
USING AIR CONDITIONERS TO REGULATE THE AIR TEMPERATURE AT THE FACE OF DEAD END MINES
A. F. Voropaev, B. D. Chizhov, Yu. A. Novoselskij, A. D. Suslov, and Yu. D. Frolov *In its* Mining Thermophysics 1968 p 52-58 In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

A mining air conditioning system is described which applies the cooling effects from the expansion of compressed air. The system comprises a rotating compressed-gas motor, a brake assembly, a damper, and an air filter. Performance parameters for the system compare favorably with those of four other cooling systems using freon coolants. Transl. by E.C.

N70-16717# Technische Hogeschool, Delft (Netherlands).
STUDY OF A SINGLE-STATE HIGH PRESSURE CENTRIFUGAL PUMP [ONDERZOEK AAN EEN EENTRAPS HOGEDRUK CENTRIFUGAALPOMP]
Wouter Gerard van Aken (Ph.D. Thesis) July 1969 88 p refs In DUTCH; ENGLISH summary
(WTHD-14)

Present technology solves the problem of pumping relatively small amounts of fluid to a high pressure by employing single-stage high-speed centrifugal pumps. Compared with the conventional medium-speed multistage pumps, the lower pump efficiency is a disadvantage. This thesis investigates the flow phenomena in high-speed pumps, and endeavours to localize the hydrodynamic losses. The results are indicative of possible design improvements. Author

N70-16751# Metaalinstituut TNO, The Hague (Netherlands). Centrum voor Metaalbewerking.
STUDY OF PRACTICAL POSSIBILITIES TO QUALITATIVE L-1 EVALUATE SPIRAL DRILLS [ONDERZOEK NAAR DE

PRAKTISCHE MOGELIJKHEDEN TOT KWALITATIEVE BEOORDELING VAN SPIRAALBOREN]
H. M. C. Adriaenssens 4 Jul. 1969 55 p refs In DUTCH (M69-435/Adr/SJ) Avail: CFSTI

Qualitative evaluation of various drill markings is only meaningful if drill types correspond to their specified application. The following methods are proposed for qualitative comparison of drilling marks: (1) a proof procedure for standardizing comparison of hand drill machines; (2) a method for hardness measurements on drills; (3)precision adjustment for measuring point oscillations; (4) precision adjustment for measuring cutting edge abrasion; and (5) precision adjustment for measuring target thickness. Transl. by G.G.

N70-16776 Society of Plastics Engineers, Inc., Detroit, Mich.
PLASTICS IN THE AUTOMOTIVE INDUSTRY Regional Technical Conference Papers
Mar. 1969 76 p refs Conf. held in Detroit, 20 Mar. 1969
Copyright. Avail: Issuing Activity

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N70-16777 Fellows Gear Shaper Co., Springfield, Vt.
COMPUTER CONTROL OF THE INJECTION MOLDING PROCESS
R. B. Currie *In* Soc. of Plastics Engr., Inc. Plastics in the Automotive Ind. Mar. 1969 18 p (See N70-16776 05-15)
Copyright. Avail: Issuing Activity.

A computer can initiate, monitor and process control certain functions of the molding process. The computer can be programmed to preset or initiate a number of the settings on the machine such as time, temperatures, pressures and flow. It can also monitor the settings to assure that they remain within the tolerances as set up in the program. It can also be programmed to adjust certain settings during the molding process. The result is equipment which provides one answer to the acute shortage of skilled labor and by virtue of its constant vigil of the process, provide more and better parts. Author

N70-16778 Standard Tool Co., Leominster, Mass.
INJECTION MOLDING OF THERMOPLASTIC STRUCTURAL FOAM
Lawrence R. Westin *In* Soc. of Plastics Engr., Inc. Plastics in the Automotive Ind. Mar. 1969 5 p (See N70-16776 05-15)
Copyright. Avail: Issuing Activity

Recent developments in the technology of injection molding of structual foam from thermo plastic materials indicate the need for an evaluation of the various basic process concepts and their application in our industry today. Two basic concepts in structural foam injection molding are used the first being a low pressure process and the second, a high pressure process. Each of the processes has definite advantages and limitations. Author

N70-16779 Marbon Chemical Corp., Washington, W.Va. Div. Design and Development.
PLASTIC ABS VEHICLE STRUCTURE MEMBERS
Dan T. Deaver *In* Soc. of Plastics Engr., Inc. Plastics in the Automotive Ind. Mar. 1969 16 p (See N70-16776 05-15)
Copyright. Avail: Issuing Activity

Details of manufacturing research vehicles of scrylonitrile butadiene styrene and results of testing are given. The ductility, high impact properties, and energy storage capability of ABS materials are considered to be promising for automotive applications. The primary cost of ABS vehicles is estimated to be the material and is expected to decrease. Present emphasis is on off-road vehicles such as dune and beach buggies, snow scooters, and amphibious units. Long range considerations include urban commuter vehicles and pick-up trucks. N.E.N.

N70-16819*# Mechanical Technology, Inc., Latham, N.Y.
RESEARCH AND DEVELOPMENT OF HIGH TEMPERATURE GAS BEARINGS. 2: SELECTION AND EVALUATION OF GAS BEARING MATERIALS IN ARGON AT 900 F and 1400 F
S. F. Murray Washington NASA Dec. 1969 145 p refs (Contract NAS3-9433)
(NASA-CR-1477) Avail: CFSTI CSCL 13I

A high temperature experimental study was made to evaluate the effect of sliding contacts on the hydrodynamic behavior of tilting pad journal bearings and on spiral grooved thrust bearings. Both start-stop and high speed rub tests were run in an argon environment at two temperatures, 900 F and 1400 F. Emphasis was placed on the use of plasma coatings to provide wear resistant surfaces. The results show that a plasma sprayed Al2O3 coating sliding against a nickel-chrome bonded chrome carbide coating is the best combination for use on both thrust and journal bearings in an inert environment in this temperature range. Selecting materials for good sliding behavior in the 900 F to 1400 F range is more difficult than it was at temperatures up to 500 F. For reliable start-stop operation of thrust bearings, without hydrostatic jacking, design stresses may have to be limited to about 2.5 psi, unless better materials or solid lubricant films are found. For Volume 1, see N70-12192. Author

N70-16862# Harry Diamond Labs., Washington, D.C.
A FLUIDIC MAIL SINGULATOR
Chris E. Spyropoulos Jul. 1969 25 p refs
(AD-695647; HDL-TR-1458) Avail: CFSTI CSCL 15/5

The feasibility of using fluidics to withdraw a single letter at a time from a horizontal stack of letters standing on edge (singulation) was investigated. Fluidic techniques were employed to accelerate the letter being singulated, sense its position, and control the letter motion so that the next letter in the stack is not moved until the preceding letter has been transported beyond a fixed point. The fluidic system is described, and the design approach and the test program conducted to determine the system performance are discussed. Feasibility was demonstrated, using ordered letters weighing from 0.12 to 1 oz where the maximum singulation rate of the 0.12-oz letters was 7.7 per second. The 1-oz letters were singulated at a maximum rate of 3.1 per second. Author (TAB)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-15540# Avco-Everett Research Lab., Everett, Mass.
A SUPERSONIC MIXING C W CHEMICAL LASER
J. R. Airey and S. F. McKay Aug. 1969 12 p refs Submitted for publication

(Contracts DAAH01-68-C-2144; F29601-69-C-0060; ARPA Order 870)
(AD-694357; AMP-287) Avail: CFSTI CSCL 20/5

The reaction F + HCl yields HF + Cl has been used to produce C. W. chemical laser action. This has been accomplished by mixing two supersonic streams of the reactant species in a shock tunnel. The time duration of the laser action is two orders of magnitude longer than the natural laser pulse in a non-flowing system, i.e. it is limited only by the flow time of the shock tunnel. Author (TAB)

N70-15551# United Aircraft Corp., East Hartford, Conn. Research Labs.
SELF MODE-LOCKING AND SATURATION PULSE SHARPENING IN A ROTATING MIRROR Q-SWITCHED CARBON DIOXIDE LASER Technical Report
S. Marcus and John H. Mc Coy Oct. 1969 13 p refs
(Contract N00014-69-C-0308)
(AD-695425; UAR-H263) Avail: CFSTI CSCL 20/5

Observation of self mode-locked pulses with a rotating mirror Q-switched CO2 laser is reported. Pulses as short as 10 nsec, narrower than the normal CO2 linewidth limit, were obtained. The shortness of these pulses is attributed to saturation broadening of the pulse spectrum. Author (TAB)

N70-15573# Avco-Everett Research Lab., Everett, Mass.
THE Cl AND HBr PULSED CHEMICAL LASER: A THEORETICAL AND EXPERIMENTAL STUDY
J. Richard Airey Aug. 1969 44 p refs Submitted for publication
(Contract DAAH01-68-C-2144)
(AD-694363; RR-336) Avail: CFSTI CSCL 20/5

The most powerful and efficient pulsed chemical lasers produced to date have resulted from the simple exothermic reactions between halogen atoms and hydrogen halides. These reactions have been initiated by flash photolysis. One such reaction is: Cl + HBr yields HCl + Br; -delta H = 15.5 Kcal/mole. A kinetic model has been developed for this laser system which calculates the intensity profile of the laser pulse as a function of time. The input data for the model includes estimates of the reaction rate into the specific vibrational levels of HCl and cross sections for collisional deactivation by the different chemical species in the laser medium. The theoretical model also requires as input data the photolysis flash intensity profile, the cavity geometry, and the losses. A discussion of the model is given and a comparison is made between experiment and theory. The model is able to predict quantitative variations of the laser pulse characteristics as a function of flash intensity, cavity losses, and reagent partial pressures. The quantitative calculations are in reasonable agreement with experiment. It is concluded that, (a) the most important single contribution to deactivation in the system is: HCl (V = 1) + HBr (V = 0) yields HCl (V = 0) + HBr (V = 1); and (b) the rate of reaction to produce HCl (V = 1) is at least as large as that to produce HCl (V = 0). Author (TAB)

N70-15574# Avco-Everett Research Lab., Everett, Mass.
THE Cl AND HBr PULSED CHEMICAL LASER: A Q-SWITCHED STUDY
J. Richard Airey Aug. 1969 21 p refs Presented at Lebedev Phys. Inst., Moscow, 2–4 Sep. 1969
(Contract DAAH01-68-C-2144)
(AD-694356; AMP-286) Avail: CFSTI CSCL 20/5

The Cl + HBr pulsed chemical laser has been operated in the Q-switched configuration. The primary purpose of the experiment is to determine the importance of collisional deactivation in the system. A comparison is made between the experimental results and predictions of a theoretical model. The model is based on the rates of the molecular processes involved and calculates pulse energy as a function of time. Good quantitative agreement between theory and experiment is obtained. It is concluded that collisional deactivation processes in this laser are strongly competitive with the rate of reaction. Author (TAB)

N70-15659# Bureau of Mines, Pittsburgh, Pa. Coal Research Center.
COAL INVESTIGATIONS USING LASER IRRADIATION
F. S. Karn, A. G. Sharkey, Jr., A. F. Logar, and R. A. Friedel Jan. 1970 36 p refs
(BM-RI-7328) Avail: Issuing Activity

Conditions necessary to obtain optimum yield of useful products when coal is rapidly heated to extreme temperatures by laser irradiation were determined. Product distribution and yield were investigated as functions of several variables. Low rank coals with high volatile matter gave highest total gas yields. Medium rank coals gave the highest yields of H2 and C2H2 and low rank coals gave highest yields of CO and CO2. Macerals gave gases of approximately the same composition, but the total gas yield increased in the order fusinite, micrinite, vitrinite, and exinite. Total gas and C2H2 yields varied inversely with particle size. The addition of nominally inert gases such as Ar, He, N2 increased yields of H2, C2H2, and total gas. Metals such as nickel and platinum had little influence on the rate of coal decomposition. Total gas yield increased with total energy of irradiation, and the ratio of C2H2 – CH4 increased with concentration of energy. A study was also made of the irradiation temperature, and a material balance was calculated. Author

N70-15685# Council for Scientific and Industrial Research, Pretoria (South Africa).
EXPERIMENTS ON THE APPLICATION OF SAMPLING BY MEANS OF LASERS TO EMISSION SPECTROSCOPY: DETERMINATION OF ELEMENTS, INFLUENCE OF THE STRUCTURE OF MATERIALS [ALCUNE ESPERIENZE SULL' APPLICAZIONE DELLA CAMPIONATURA MEDIANTE LASER ALLA SPETTROSCOPIA DI EMISSIONE: DETERMINAZIONE DI ELEMENTI, EFFETI DELLA STRUTTURA DEI MATERIALI]
E. Cerrai et al 1969 17 p refs Transl. into ENGLISH from Met. Ital. (Milan), no. 8, 1967 p 615–620
Avail: CFSTI

This paper reports on results of experiments in emission spectroscopy using a laser for the localised evaporation of the sample. The microprobe laser was used, together with a high voltage secondary spark discharge, for carrying out microanalyses of a variety of samples. A description is given of analyses of steels, analyses of fine layers of oxide on zirconium alloys, investigations of the microstructures of metallic samples. Emphasis is on the utilization of the laser probe as a means of carrying out spectrography suitable for microanalyses, not as a substitute for the normal methods of excitation with integration. Author

N70-15801*# Northeastern Univ., Boston, Mass. Photochemistry and Spectroscopy Lab.
INVESTIGATION OF NEW SYSTEMS FOR POTENTIAL LASER ACTION Quarterly Report, 1 Jun. – 30 Sep. 1969
John L. Roebber 12 Nov. 1969 16 p ref
(Grant NGR-22-011-025)
(NASA-CR-107589; QR-3) Avail: CFSTI CSCL 20E

The metal compounds which undergo photodissociation were selected for research, in seeking new chemical systems which exhibit laser action. The emission spectra produced in the vacuum ultraviolet region by metal halide vapors excited by microwaves, and the absorption spectra of the mercury halides in the 1600 to 1050A region are described. Experimental results are tabulated. F.O.S.

N70-15878# Brandeis Univ., Waltham, Mass. Dept. of Physics.
THE ELECTROMAGNETIC FIELD AND LASER DYNAMICS IN A CAVITY BOUNDED BY MOVING MIRRORS

Gerald T. Moore (Ph.D. Thesis) Jun. 1969 125 p refs
(Contract F19628-68-C-0062)
(AD-695816; AFCRL-69-0250; SR-5) Avail: CFSTI CSCL 20/5

The propagation of light in a one-dimensional cavity bounded by moving mirrors is studied in the context of the theory of gas lasers. A canonical quantization of the free field is carried out by utilizing the symplectic structure of the space of solutions of the wave equation. It is shown that no Hamiltonian and no Schrodinger picture exists and that the photon number operator is in general not conserved. Changes in the number operator are, however, ordinarily too small to be observed experimentally. Automorphic coordinate transformations are used to develop adiabatic expansions for the mode functions of cavities with one fixed and one moving mirror. The coupling of the field to two-level atoms is done both quantum-mechanically and semi-classically. For the interacting quantum field an interaction Hamiltonian does exist, even though there is no total Hamiltonian. The semi-classical equations treat the atomic density matrix as a distribution in phase space. They possess traveling wave solutions which are expected to be important in understanding the behavior of mode-locked lasers. Author (TAB)

N70-16059# United Aircraft Corp., East Hartford, Conn. Research Labs.
EFFECTS OF DIFFUSION ON THE SATURATION INTENSITY OF A CO SUB 2 LASER
David C. Smith and John H. Mc Coy Jun. 1969 16 p refs
(Contract N00014-69-C-0308)
(AD-694547; UAR-H218) Avail: CFSTI CSCL 20/5

The power and gain capabilities of a CO2 laser are dependent upon the saturation intensity of the laser media. Saturation intensities reported in the literature range from 22 watts/sq cm to 100 watts/sq cm for seemingly similar laser discharge tube bores, currents, gas flow rates and gas mixtures. Measurements of saturation intensities between 7.5 and 57 watts/sq cm in a CO2 laser amplifier indicate that this perameter is inversely related to the radius of the amplified beam. A significant increase in saturation intensity for small beam radii is attributed to diffusion of excited CO2 molecules into the beam. The experimental results are in qualitative agreement with a simplified derivation of a relation governing the saturation intensity which includes molecular diffusion. This effect can result in a serious overestimate of the capabilities of a large beam laser system designed with saturation intensities obtained from small diameter probe beams. Author (TAB)

N70-16132*# Aztec School of Languages, Inc., Maynard Mass. Research Translation Div.
LASER INTERFEROMETRY OF PARTIALLY IONIZED PLASMA [LAZERNAYA INTERFEROMETRIYA CHASTICHNO IONIZOVANNOY PLAZMY]
L. N. Pyatnitskiy et al Washington NASA Jan. 1970 5 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (Moscow), v. 7, no. 4, 1969 p 780–781
(Contract NASw-1692)
(NASA-TT-F-12769) Avail: CFSTI CSCL 20E

To overcome the difficulties of determining the number of electrons in a partially ionized plasma, it is necessary to determine the refractive index of the latter on several frequencies simultaneously. A device consisting of three independently operating gas lasers coupled to a Fabry-Perot interferometer is described; changes in optical path length are used to measure frequency shifts, and thus to determine the refractive index and electron concentration. Author

N70-16412# United Aircraft Corp., East Hartford, Conn. Research Labs.
TWO SATURABLE ABSORBERS FOR EXTENDING THE WAVELENGTH LIMITS OF A PASSIVELY Q-SWITCHED CO 2 LASER
S. Marcus Jul. 1969 13 p refs
(Contract N00014-69-C-0308)
(AD-694027; UAR-H234) Avail: CFSTI CSCL 20/5

The discovery of two new passive Q-switching agents for use in the CO2 laser is reported. These gases, chlorotrifluoroethylene and difluorodichloromethane, permit extension of the range of wavelengths over which the passively Q-switched CO2 laser can be operated. Saturation intensities and small signal absorption coefficients were measured for these gases. Author (TAB)

N70-16484# United Aircraft Corp., East Hartford, Conn. Research Labs.
CONTINUOUS MODE LOCKING OF A CO 2 LASER
John H. Mc Coy Aug. 1969 10 p refs
(Contract N00014-69-C-0308)
(AD-694026; UAR-H230) Avail: CFSTI CSCL 20/5

An optical delay line is used to form a 45 meter long CO2 laser cavity. Continuous locking of the longitudinal cavity modes has been observed with SF6 or BCl3 in the cavity. The laser output is a continuous train of uniform amplitude pulses occurring at 300 nanosecond intervals. The observed pulse widths of 60 to 70 nanosecond corresponds to locking 5 or 6 modes in a 13 to 18 MHz bandwidth. Author (TAB)

N70-16726# United Aircraft Corp., East Hartford, Conn.
RESEARCH INVESTIGATION OF LASER LINE PROFILES (PICOSECOND LASER PULSES) Semiannual Report, 1 Mar. – 31 Aug. 1969
Anthony J. De Maria, William H. Glenn, Jr., George L. Lamb, Jr., Michael E. Mack, and E. Brian Treacy 30 Sep. 1969 105 p refs 1969
(Contract N00014-66-C-0344; ARPA Order 306A-15; Proj. Defender)
(AD-694548; UARL-HS20479-17) Avail: CFSTI CSCL 20/5

Topics discussed include theoretical and experimental work made on the propagation of ultrashort light pulses, stimulated scattering effects, nonlinear propagation, adiabatic inversion of quantum states, organic dye lasers and stimulated emissions from laser produced plasmas. Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-15853# Naval Research Lab., Washington, D.C.
BEHAVIOR OF MECHANICAL PROPERTIES IN NEUTRON IRRADIATED 12 Ni-5Cr-3Mo MARAGING STEEL PLATE AND COMPANION WELD METALS Interim Report
R. A. Gray, Jr. and J. R. Hawthorne 2 Oct. 1969 20 p refs
(AD-696057; NRL-6945) Avail: CFSTI CSCL 18/10

Changes of Charpy-V-notch ductility and tensile strength in neutron-irradiated 12Ni-5Cr-3Mo maraging steel have been evaluated following low (less than 250F) and elevated (550 to 740F) temperature exposure. The study was performed with six heats of 1-in.-thick plate material aged at 900F for 2 and 20 hr to nominal yield strengths of 160 and 180 ksi, respectively. The long-term thermal stability of both heat-treatment conditions was investigated for the conditions of irradiation. The less than 250F and 550F irradiation performance of matching (18-5-3) and mismatching (17Ni-2Co-3Mo) TIG weld deposits maraged to 180 ksi yield strength was also assessed in this study. Changes in the general properties of the 12-5-3 maraging steel plate and companion weld metals were found to be rather small with less

than 250F exposures, indicating good resistance to neutron-induced embrittlement. However, a marked deterioration of notch-ductility properties with long-term exposure at elevated temperature was revealed and traced to a nonnuclear thermal instability. The observed instability is believed to be a continuation of aging processes at temperatures well below the initial maraging temperature. Extended time-at-temperature treatments indicate that service above 550F may produce sufficient changes in properties for failure by low-energy tear. Aging treatments of 1900 to 3300 hours duration increased the yield and tensile strengths of the 12-5-3 alloy by as much as 52.0 and 53.3 ksi, respectively, while not altering appreciably the percentage of elongation and the reduction in area. Author (TAB)

N70-15582# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Special Projects Section.
GRAIN MORPHOLOGY CONTRIBUTION TO STRESS CORROSION SUSCEPTIBILITY IN 7075 ALUMINUM ALLOY
G. Geschwind and P. N. Adler Dec. 1969 18 p refs
(RM-466) Avail: CFSTI

Stress corrosion and mechanical property measurements on short transverse tensile specimens cut from a 3 in × 6 in × 12 ft rolled 7075-T651 bar revealed a systematic variation with position along the transverse direction. Highest stress corrosion susceptibility and lowest strengths were observed for samples cut from the center of the bar. The variation with position is explained in terms of grain size and anisotropy; both are maximum at the center of the bar. The average stress acting normal to the grain boundary is shown to vary with anisotropy and is suggested as being significant to intergranular stress corrosion. Author

N70-15591# Naval Research Lab., Washington, D.C. Metallurgy Div.
ARPA COUPLING PROGRAM ON STRESS-CORROSION CRACKING Quarterly Report
G. Sandoz, ed. Jul. 1969 78 p refs
(ARPA Order 878)
(AD-696055; NRL-Memo-2028; QR-11) Avail: CFSTI CSCL 11/6

A progress report is given of research investigations being carried out on the problem of stress-corrosion cracking of high strength materials. Work at Carnegie-Mellon University, Lehigh University, Georgia Institute of Technology, The Boeing Company, and the Naval Research Laboratory, concerning test techniques, materials characterization, physical metallurgy, surface studies, and corrosion fatigue is described. The report is divided into three main sections covering work on high strength titanium, steel, and aluminum. Included is a section containing abstracts of recently published reports, journal articles, and talks generated under ARPA Order 878. Selected abstracts of articles from outside the ARPA program in the field of stress-corrosion cracking are also included as well as a Diary of Events section. Author (TAB)

N70-15593# Boeing Co., Renton, Wash. Commercial Airplane Group.
THE STRESS CORROSION RESISTANCE AND FATIGUE CRACK GROWTH RATE OF A HIGH STRENGTH MARTENSITIC STAINLESS STEEL, AFC 77
Donald Webster Jun. 1969 12 p refs
(Contract N00014-68-C-0365; ARPA Order 878)
(AD-695794; D6-23973) Avail: CFSTI CSCL 11/6

The plane-strain corrosion threshold K sub(Iscc) and fatigue crack growth rate have been determined for a high strength martensitic stainless steel, AFC 77, in both conventionally processed and strain-aged conditions. The K sub(Iscc) (in 3.5-percent sodium chloride solution) is markedly affected by both the tempering temperature and the degree of strain aging. The highest K sub(Iscc) of 105 ksi square root of in. was obtained by tempering at 500F and the lowest K sub (Iscc) of 10 ksi square root of in. by tempering at 1100F. Retained austenite raised K sub(Iscc) at tempering temperatures up to 1000F, which was the highest tempering temperature at which austenite could be maintained. Fatigue crack growth rates in both dry air (< 10 percent relative humidity) and 3.5-percent sodium chloride solution were at a maximum for material tempered at 700F. Over the range of stress intensity studied, retained austenite reduced fatigue crack growth rate in salt solution but increased it in dry air. Author (TAB)

N70-15594# Boeing Co., Renton, Wash. Commercial Airplane Group.
STAINLESS STEELS CAN BE STRONG AND TOUGH
Donald Webster Aug. 1969 12 p
(Contract N00014-68-C-0365; ARPA Order 878)
(AD-695795; D6-24379) Avail: CFSTI CSCL 11/6

The competitive position of high strength stainless steels in the aerospace industry is reviewed in light of the significant improvements in mechanical properties that have been achieved in the past year. Author (TAB)

N70-15608# Joint Publications Research Service, Washington, D.C.
SELECTIONS FROM BOOK ON PRECISION ALLOYS
24 Nov. 1969 65 p refs Transl. into ENGLISH from the book 'Pretsizionnyye Splavy' Moscow, 1968 p 30–43, 46–55, 56–64, 64–76, 99–103
(JPRS-49294) Avail: CFSTI

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3. FINE TAPES FROM PRECISION ALLOYS E. A. Lyubenko et al p 31–42 refs (See N70-15611 05-17)
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N70-15609# Joint Publications Research Service, Washington, D.C.
TRANSFORMER STEEL WITH CUBIC TEXTURE
V. N. Gorbachev et al *In its* Selections from Book on Precision Alloys 24 Nov. 1969 p 1–17 refs (See N70-15608 05-17)
Avail: CFSTI

The characteristic feature of cubic texture is a predominant grain orientation where the sheet plane contains a cube plane (100), and a cube edge of 001 is present along the roll direction. Three conditions under which the formation of such texture may take place are: (1) during secondary recrystallization; (2) as a result of repeated low temperature primary recrystallization; or (3) from billets with a cast axial structure of 100 or with existing cubic texture. A method was developed for preparing the steel with a thickness of 0.35–0.50 mm, using a billet with an axial texture of 100 obtained by an electroslag technique. The optical means of reducing the stock is cold rolling with high temperature annealing in a pure, dry hydrogen medium. The effect of temperature changes on texture during intermediate thermal processing was determined, and two methods were derived to achieve cubic texture in the final layer. Transformer steel with a developed cubic texture between 70% and 80% and high magnetic properties along and athwart the roll direction was also obtained. This material is considered comparable to two existing rib-texture steels. Author

N70-15610# Joint Publications Research Service, Washington, D.C.
PHYSICO-TECHNOLOGICAL RESEARCH ON

SUPERCONDUCTING ALLOY 65BT

N. B. Gorina et al *In its* Selections from Book on Precision Alloys 24 Nov. 1969 p 18–30 refs (See N70-15608 05-17)
Avail: CFSTI

Research on various niobium–titanium compounds resulted in development of a new alloy (65BT) which contains 65% Nb, 25% Ti, and a number of other components that are technologically valuable. The principal difficulty in the hot deformation of the alloy is its intense interaction with air during heating; in addition to the formation of an oxide coating, there is also a rapid penetration of oxygen into the interior layers that causes reduction in plasticity. The dimensions of the oxide layers were determined as a function of temperature and prolonged heating using hot-rolled samples. Resulting patterns in the interaction between the alloy and the gaseous phase were identified which aided in selection of control patterns for heating at all stages of reduction. Variations in critical current density for superconducting wire using 65BT alloy were also analyzed, and its overall superconducting properties were evaluated. Results indicate that the material satisfies all requirements for deformed superconducting alloys and is also suitable for manufacturing high efficiency magnetizing devices used in fields as strong as 6.4 Ma/m (80 ka) and above. A.C.R.

N70-15611# Joint Publications Research Service, Washington, D.C.

FINE TAPES FROM PRECISION ALLOYS

E. A. Lyubenko et al *In its* Selections from Book on Precision Alloys 24 Nov. 1969 p 31–42 refs (See N70-15608 05-17)
Avail: CFSTI

Full-scale production processes were developed for precision alloy tapes in the thickness range from 0.003 to 0.0015 mm. Specimens of 0.001 mm were produced on a laboratory scale. It was found that very thin tapes from thin tapes from several magnetically soft alloys, identified as 77NMD, 79MD, and 80NMA, exhibit a low switching coefficient, a low coercive force, and good hysteresis loop squareness. The 77NMD alloys is less sensitive to heat treatment and shows good reproducibility of magnetic properties from melt to melt. Tapes from an iron–nickel compound alloyed with aluminum have a hysteresis loop that is wide and square and pulse characteristics near those of tapes from the 79NM material. Thermomagnetic treatment in a transverse magnetic field makes it possible to obtain cores from tape with a thickness in the micron range with relatively low residual induction. Author

N70-15612# Joint Publications Research Service, Washington, D.C.

LAMINATED THERMOMAGNETIC MATERIALS

I. G. Gutkovskiy *In its* Selections from Book on Precision Alloys 24 Nov. 1969 p 43–59 refs (See N70-15608 05-17)
Avail: CFSTI

The production process for a new product, laminated thermomagnetic material (TKM), is described, and an evaluation of its properties and usefulness is given. Analysis of six trademarks of TKM produced on a pilot project shows that the materials exhibit a number of advantages in comparison with other thermomagnetic alloys: (1) Their properties can be calculated. (2) They show a substantially wider range of magnetic characteristics for a given technology. (3) Their performance is not dependent on intermediate deformations and heat treatments, but is fully determined by the final heat treatment. (4) They have a weak field strength dependence of saturation and a low induction in the high temperature portion of the curve. The characteristics of all thermomagnetic alloys are strongly dependent on chemical composition, however, and the calculated composition of the TKM components must therefore be maintained with the highest possible accuracy. Author

N70-15613# Joint Publications Research Service, Washington, D.C.

EFFECT OF COOLING IN A MAGNETIC FIELD ON THE MAGNETIC HYSTERESIS OF Nb–Sn SUPERCONDUCTING ALLOYS

N. N. Potapov *In its* Selections from Book on Precision Alloys 24 Nov. 1969 p 60–65 refs (See N70-15608 05-17)
Avail: CFSTI

Various compositions of Nb–Sn compounds, particularly those in the proximity Nb3Sn, were studied to determine the dependence of residual induction and maximum magnetic energy density on composition and heat. Since the magnetization of hard semiconductors is dependent on their cross section, the hysteresis of samples identical in composition, but differing in diameter, was also compared. A.C.R.

N70-15638 National Lending Library for Science and Technology, Boston Spa (England)

INFLUENCE OF SILICON ON THE SUSCEPTIBILITY TO PITTING OF 20/20 STEEL

S. M. Novokschenova et al 10 Jul. 1969 11 p refs Transl. into ENGLISH from Zashchita Metal. (Moscow), v. 4, no. 6, Nov.–Dec. 1968 p 685–689 In ENGLISH and RUSSIAN
(NLL-LTI-746-115-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: ,1 NLL photocopy coupons

In the present work, using corrosion and electrochemical measurements, a study was made of the susceptibility to pitting of 20/20 type chromium-nickel steels with various silicon contents. It was established that adding silicon to this steel lowers its susceptibility to pitting corrosion. The maximum effect is attained at silicon contents above 3%. Silicon significantly alters the kinetics of pitting corrosion. From potentiometric measurements it follows that the beneficial action of silicon is due to an increase in the corrosion resistance of the steel in the passive condition. Author

N70-15680# Bureau of Mines, Minneapolis, Minn. Metallurgy Research Center.

PRETREATING STEEL SCRAP TO SPEED OXIDATION

S. E. Khalafalla, S. L. Payne, and G. W. Reimers Jan. 1970 23 p refs
(BM-RI-7332) Avail: Issuing Activity

The extremely sluggish oxidation of steel scrap was appreciably accelerated when the charge was pretreated in aqueous solutions of sodium metavanadate or sodium molybdate. The degree of oxidation acceleration was inversely correlated with the melting point of the promoter oxide possessing the highest valency. The magnitude of oxidation enhancement exhibited a systematic inverse dependence on the duration of pickling processes; more dipping of the oxidizable charge in the vanadate bath was most effective. In general, the rate of steel scrap oxidation increased with increasing concentration of the pickling reagent. The results are explained on the basis of the hydrolytic decomposition of the pickling agent with subsequent slow interaction with the metal surface, coupled with the tendency of vanadium to form polyanions in alkaline media. The data not only served to elucidate the mechanism by which catastrophic oxidation takes place, but also showed that the accelerating species need not be alloyed with the oxidizable metal; surface impregnation by minute amounts of the accelerating species can still produce catastrophic effects. Author

N70-15690*# College of William and Mary, Williamsburg, Va.

TEMPERATURE VARIATION OF THE RESISTIVITY OF METALLIC STRAIN GAUGE MATERIALS Final Report

Arden Sher, Gideon Weisz, and An-Ban Chen [1969] 23 p refs
(Grant NGR-47-006-045)
(NASA-CR-66883) Avail: CFSTI CSCL 11F

Some transition metal alloys used in strain gauges, have resistivities which are large and vary much more slowly with temperature than usual metals. In an attempt to understand the lack of temperature dependence of these high resistivity alloys the theory of the deformation potential interaction between an electron

and a longitudinal phonon was extended into the high collision rate regime. It is demonstrated that if the deformation potential decreases with increasing collision rate then the resistivity should become independent of temperature. It was found however, that the deformation potential was even more independent of electron collision rate than previously reported. As a consequence this effect cannot account for the observed lack of temperature dependence of the alloys of interest. Author

N70-15698 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.

DETERMINATION BY MEANS OF STATIC BEND TESTS OF MECHANICAL PROPERTIES OF GAS-CARBURIZED AND GAS-CARBONITRIDED 18 NiCrMo 14 CASE-HARDENING STEEL

H. J. Laudenberg Mar. 1969 194 p Transl. into ENGLISH from a German Thesis In GERMAN and ENGLISH
(NLL-Trans-746/65-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .13 NLL photocopy coupons

Static bend tests were conducted to establish the mechanical properties of 18 NiCrMo 14 case-hardened steel. It was ascertained whether the gas carburizing plant with direct control of the carbon potential in the furnace via the dewpoint of the carrier gas obtained by cracking of a propane-air mixture was adequate or whether the plant could be supplemented and improved by additional direct carbon potential measurement and control via electrical resistivity measurements. The effects of austenitizing temperature and period, tempering temperature and period, and annealing and low-temperature treatment were investigated. Carbon contents and case depths were varied and the effect of grinding on mechanical properties established by static bend tests was ascertained. The mechanical properties of large bend specimens were determined to establish any possible influence of specimen section size. Author

N70-15718 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.

WETTING OF REFRACTORY CARBIDES BY LIQUID METALS

G. V. Samsonov et al Feb. 1969 14 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), v. 8, no. 11, Nov. 1968 p 42–48 In RUSSIAN and ENGLISH
(NLL-LTI-746-100-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

The wetting of carbides of groups IV, V, VI of a periodical system with melted non-transient and transient metals were studied. It is established that non-transient metals do not wet carbides of groups IV-VI, and transient ones wet carbides of groups V and VI, but do not wet IV group of carbides. Temperature and time dependences of wetting are studied as well as the effect of studied porosity on a boundary angle. Wetting was studied of refractory carbide coatings on metals with melted metals. An attempt was made to explain the nature of wetting processes from the concept of electronic structure of carbides and metals. Author

N70-15719 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.

SOME ASPECTS OF THE INTERGRANULAR CORROSION OF CORROSION-RESISTANT STEELS

V. Cihal Jul. 1969 36 p refs Transl. into ENGLISH from Zashch. Metal. (USSR), v. 4, no. 6, Nov.–Dec. 1968 p 637–655 In RUSSIAN and ENGLISH
(NLL-Trans-746-210-(9022.401)) Avail: Natl. Lending Library, Boston, Spa, Engl.: .4 NLL photocopy coupons

In analyzing the individual aspects of intercrystalline corrosion of corrosion-resistant steels, particular attention is given to carbide precipitation and structural changes at elevated temperatures as the principle factors responsible for susceptibility to intercrystalline corrosion. The role of potentiostatic polarization curves in the determination of regions of intercrystalline corrosion initiation is emphasized. An example is given of the factors exerting a decisive influence on the resistance of steels to intercrystalline and knife-edge corrosion, thermal conditions prevailing in the vicinity of welds, and methods of preventing these forms of corrosion attack. The study was mainly concerned with intercrystalline corrosion of the widely used chromium-nickel austenitic steels. Author

N70-15737 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.

INFLUENCE OF OXIDATION OF METALS ON THEIR HEAT-RESISTING PROPERTIES

A. V. Ryabchenkov et al Jun. 1969 14 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (USSR), no. 12, Dec. 1968 p 21–26 In RUSSIAN and ENGLISH
(NLL-Trans-746-191-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A study was made of the fatigue strength and stress-rupture characteristics of constructional materials in oxidizing and inert environments. It was established that, in oxidizing media, when an oxide film forms on the metal surface, the heat resistance is higher than in tests in inert atmospheres which do not lead to the generation of an oxide film on metal. With rising test temperature and increasing test duration, this difference in the level of cyclic and long-time strength increases. An examination has been made of the principal physico-chemical processes responsible for the strength loss of the surface metal layer in non-oxidizing media and its strengthening in oxidizing environments. The main methods of improving the heat-resistance of constructional materials are discussed and new principles of alloying of steels and alloys intended for operation at high temperatures in non-oxidizing gaseous environments are proposed. Author

N70-15738 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.

SINTERED STEEL PRODUCTS WITH COMPENSATED SHRINKAGE

W. Missol Feb. 1969 17 p Transl. into ENGLISH from Prace Inst. Hutniczch (Katowice), v. 19, no. 6, 1967 p 397–403 In POLISH and ENGLISH
(NLL-LTI-746-102-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL Photocopy coupons

Economical advantages of compensating the shrinkage in sintered machine parts are pointed out. The influence of copper addition on the dimensional changes and of the copper and nickel addition on the mechanical properties of sintered steel products made from the RZ-type atomized iron powder are discussed. It was found that, in order to obtain high strength properties, it is essential to use simultaneously copper and nickel addition. Introduction of copper into sintered steel makes precipitation hardening possible, moreover, this treatment can, in certain circumstances, be carried out in a single operation with sintering. Author

N70-15798# Franklin Inst., Philadelphia, Pa. Research Labs.

A BASIC STUDY OF COLD WELDING IN ULTRAHIGH VACUUM

Hans Conrad and L. Rice 30 May 1969 87 p refs
(Contract Nonr-4825(00))
(AD-694015; F-B2368) Avail: CFSTI CSCL 11/6

The cohesion of the FCC metals Ag, Al, Cu, and Ni, under ultrahigh vacuum was investigated by cold welding specimens previously fractured in the vacuum. The cohesion strength of the weld increased with compression load for all metals; all data fall on one curve of slight positive curvature when the cohesion load

(stress) and the compression load (stress) were divided by the initial fracture load (stress) of the virgin specimen. The effect of compression load on the cohesion coefficient alpha, for all metals could be described by alpha = 0.75 + 0.15 LC/LFo, where LC is the compression load and LFo is the initial fracture load. Ultrasonic measurements and microscopic examination of Cu specimens indicated that the contact area was proportional to the ratio LC/LFo and that excellent matching of the fractured surfaces was possible with the apparatus used. The cohesion results are explained on the basis that the rupture of the weld occurs at a constant value of the true fracture stress. Heat treatment reduced the strength of copper welds and alloying (70-30 Brass) lowered the cohesion coefficient compared to unalloyed Cu. Prolonged exposure of copper fracture surfaces to the gases O2, CO, CO2 and air caused an appreciable reduction in the cohesion coefficient, whereas no effect was observed for N2. This is in good agreement with predictions based on absorption theory and observations reported for LEED studies. Author (TAB)

N70-15823 National Lending Library for Science and Technology, Boston Spa (England).
EQUILIBRIUM IN THE SYSTEM NICKEL–SULPHUR–OXYGEN
S. B. Chuchmarev et al 21 Jul. 1969 12 p refs In RUSSIAN and ENGLISH Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (Dzaudzhikau), v. 10, no. 6, 1967 p 32–37
(NLL-LTI-746-163-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl .1 NLL photocopy coupons

Thermodynamic equilibrium characteristics of the nickel–sulfur–oxygen system were investigated using isothermal decomposition techniques in a lass circulating pump. The dependence of the equilibrium constant of the lower nickel sulfide and nickel oxide reaction on temperature was more accurately determined; the values of the constant at temperatures of 1000, 1100, and 1200 C were found to be 0.005, 0.0178, and 0.135, respectively. The values of equilibrium partial pressures P sub SO2 min for the equilibrium between metallic nickel and its sulfide and oxide were also determined. The formation of metallic nickel in the above system can take place at relatively low temperatures, provided that the pressure of SO2 in the gaseous phase is less than P sub SO2 min. It is suggested that this reaction may take place during the fluid bed roasting of sulfide nickel intermediate products. M.H.E.

N70-15860 National Lending Library for Science and Technology, Boston Spa (England).
CAST IRON FOR BLADES OF SHOT-BLASTING IMPELLERS
B. I. Vashchenko et al 21 Jul. 1969 5 p In RUSSIAN and ENGLISH Transl. into ENGLISH from Litsinoe Proizv. (Moscow, no. 12, Dec. 1968 p 28–29
(NLL-LTI-746-217-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl .1 NLL photocopy coupons

The analysis of cast iron alloys for tensile impact and bending strengths and bending deflection are presented for cast iron blades in shot-blasting impellers. Structural homogeneity when rare-earth elements were added is discussed. Alloy temperatures were shown when gyromagnetic currents were created. Electron fluctuations caused formation of strong metallic bonds which improved the microstructure of the alloy. J.M.

N70-15904# Iowa State Univ. of Science and Technology, Ames.
GROUP 4 AND 5 TRANSITION METAL RICH CHALCONIDE X-RAY POWDER DIFFRACTION DATA
H. F. Franzen, J. G. Smeggil, and B. R. Conrad Aug. 1969 18 p refs
(Contract W-7405-eng-82)
(IS-2133) Avail: CFSTI

Guinier powder diffraction data are tabulated for the following metal-rich chalconide compounds: Ti2S, Ti2Se, Zr2S, Zr2Se, Hf2S, Hf2Se, HfSe, Nb21S8, Nb2Se, Ta2S, and Ta6S. Author (NSA)

N70-15906# Iowa State Univ. of Science and Technology, Ames.
PHENOMENOLOGY BASED ON POINCARE GROUP ANALYSIS
Edward Owen Thorland Aug. 1969 133 p refs
(Contract W-7405-eng-82)
(IS-T-324) Avail: CFSTI

A review is made of the Poincare group and (via little group theory) of its irreducible unitary representations, with special emphasis on the space like and continuous spin light like cases. Several Clebsch–Gordan coefficients are derived (in a general frame) and are written in such a manner that their symmetry properties are easily obtained. The Clebsch–Gordan coefficients are applied in a general theory of partial wave expansions which places cross channel expansions on a level with the usual direct channel expansion. A possible connection between the space like crossed expansion and Regge theory is investigated in some detail. The time like and light like cross channel (u channel) expansions for pion-nucleon elastic scattering are carefully investigated, particularly near u - 0. CERN phase shift data is used to numerically perform the cross channel partial wave analysis. Author (NSA)

N70-15917 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF LOW-TEMPERATURE ANNEALING ON THE PROPERTIES OF NICKEL POWDERS, PART 1
I. M. Fedorchenko et al 21 Jul. 1969 9 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), v 9, no. 1, Jan. 1969 p 29–33 In ENGLISH and RUSSIAN
(NLL-LTI-746-135-(9022.401)) Avail: Natl. Lending Library Boston Spa Engl.: .1 NLL photocopy coupons

Powdered nickel was prepared by electrolysis of aqueous solutions of nickel salts, decomposition of nickel carbonyls, and reduction of nickel oxides in hydrogen at low annealing temperatures. The preparation techniques effect on the particle size and shape, specific surface area, electrical conductivity, and fabrication characteristics was determined. Differences in the fabrication characteristics were found resulting from lattice distortions and crystalline structure concentration. A rise in temperature caused a lowering of the electrical conductivity. Other temperature effects were in the annealing process in hydorgen atmosphere. M.C.

N70-15966 Bethlehem Steel Co., Pa. Metallurgical Div.
STEELS FOR PLASTIC MOLD DIES
John W. Sullivan *In* Soc. of Plastics Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 41–49 (See N70-15959 05-18)
Copyright. Avail: Issuing Activity

The characteristics of plastic-molding die steels currently available are briefly described, and the metallurgical properties of two types of mold steels recently developed for this purpose are reviewed. The first material was designated S-7 under the AISI classification, and the other is a preheat-treated type with good deep-hardening characteristics. Author

N70-15988 National Lending Library for Science and Technology, Boston Spa (England).
HOMOGENEITY OF ELECTROLYTIC IRON-NICKEL POWDERS
L. D. Konchakovskaya et al 21 Jul. 1969 9 p refs In RUSSIAN and ENGLISH Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), v. 9, no. 1, Jan. 1969 p 25–28
(NLL-LTI-746-152-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl .1 NLL photocopy coupons

Concentration distributions are studied in iron–nickel electrolytic powders, obtained by joint electric precipitation. Electrolytic powders are compared with carbonyl powders of the same compositions. A great initial homogeneity of electrolytic powders and delayed speed of their homogenization is established when increasing the temperature of annealing. Author

N70-16071 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.

INFLUENCE OF STACKING-FAULT ENERGY ON THE CREEP OF fcc METALS

V. I. Shalaev et al Jul. 1969 16 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), v. 27, no. 2, Feb. 1969 p 331–338 In RUSSIAN and ENGLISH

(NLL-Trans-746-232-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

A study was made of the influence of stacking-fault energy on the steady state creep rate and time to rupture of fcc metals, (Ag, Ni, Pd, Pt, Al). It is shown that, in the region of 0.7 T(melt), where dislocation climb appears to control plastic deformation, the rate of steady state creep and time to rupture strongly depend on the stacking-fault energy of metals. Author

N70-16072*# National Aeronautics and Space Administration, Washington, D.C.

THE RELATIONSHIP BETWEEN WORK FUNCTION AND THE PHYSICAL PROPERTIES OF SOME TRANSITION METALS [O SVYAZI RABOTY VYKHODA S FIZICHESKIMI KHARAKTERISTIKAMI NEKOTORYKH PEREKHODNYKH METALLOV]

G. V. Samsonov et al Jan. 1970 5 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy, Fiz. (USSR), no. 6, 1968 p 103–105

(NASA-TT-F-12737) Avail: CFSTI CSCL 11F

The work function was compared to the resistivity at approximately –195 C and the Hall coefficient at room temperature. These properties are shown to depend on the statistical weight of the stable d(5) electron configuration of atoms in crystals. The work function and the Hall coefficient were found to increase as the statistical weight increases, and the resistivity to decrease. It is concluded that the bulk properties of the metal and its electronic structure are determining factors in explaining the thermionic emission characteristics of the metal. N.E.N.

N70-16125# Argonne National Lab., Ill.

CORROSION OF VANADIUM AND VANADIUM-BASE ALLOYS IN SODIUM

W. E. Ruther May 1969 39 p refs

(Contract W-31-109-eng-38)

(ANL-7505) Avail: CFSTI

Vanadium and certain stronger vandium-base alloys (V-5 wt % Cr, V-10 wt % Cr, V-15 wt % Cr-5 wt % Ti, V-15 wt % Ti-7.5 wt % Cr, and V-20 wt % Ti) were exposed to sodium cold-trapped at two temperatures (110 and 175 C). The temperatures of exposure varied from 450 to 700 C. Linear rates of weight loss were noted at the higher impurity level in the sodium. Under optimum conditions, very low weight and dimensional changes were noted for vanadium and the vanadium–chromium binary alloys after exposure in sodium cold-trapped at 110 C. Results of postexposure chemical analyses indicated that oxygen was the major impurity transferred to the vanadium alloys. Titanium as an alloying additive caused increased impurity pickup and concentrated the impurities in a subsurface band .001 to .01 mm thick. The vanadium–chromium binary alloys were the most corrosion-resistant at the lower cold-trap temperature and appeared to offer promise as a reactor fuel cladding. Author (NSA)

N70-16138# Oxford Univ. (England). Engineering Lab.

THE EFFECT OF STRAIN RATE ON THE ROOM TEMPERATURE STRENGTH AND DUCTILITY OF FIVE HIGH-STRENGTH STEELS Interim Report

J. Harding and J. D. Campbell Sep. 1969 41 p refs Sponsored by Naval Construct. Res. Estab. and Sci. Res. Council

(Rept-1090-69; IR-4) Avail: CFSTI

Stress-strain curves are presented for five high-strength steels, BS.968, UXW, QT.35, HY.80, and HY.100, tested in tension at mean plastic strain rates from 103 to 2000 sec1. Strain-rate sensitivity curves are derived for the flow stress at 2.5 percent plastic strain and for the elongation and the reduction of area at fracture. The variation of the upper yield stress with the elastic strain rate at yield for the UXW steel is compared with previous results for the same steel and an explanation is proposed for the apparent linear dependence on strain rate found in both investigations. The strain-rate sensitivity curves for the flow stress may be divided into regions corresponding to athermal, thermally activated, and viscous damped mechanisms of flow as previously found in tests on mild steel. There appears to be little effect of strain rate on the room temperature ductility of the five high-strength steels tested. Author (ESRO)

N70-16146# Naval Civil Engineering Lab., Port Hueneme, Calif.

DYNAMIC TESTS ON SELECTED STRUCTURAL STEELS Technical Report Jul. 1967–Jun. 1968

W. L. Cowell Sep. 1969 29 p refs Sponsored by DASA

(AD-695375; R-642; DASA-SC318) Avail: CFSTI CSCL 11/6

Dynamic tension tests and static tension tests were conducted on four grades of structural steels. The steels conform to ASTM grades A36, A242, A441, and A572. Stress-strain curves are presented for each steel at various strain rates, ranging from static to about 1.5 in./in./sec. While all steels showed an increase in yield stress with increasing strain rates, the A36 steel showed the greatest increase. Design recommendations are given for structural steels subjected to high strain rates. Additional specimens were strain aged, and stress-strain curves were obtained for both dynamic and static tests. Of the strain-aged steels, only the A36 steel showed a significant increase in strength over the non-strain-aged steels, when loaded dynamically. No adverse effects of strain aging were noted on any of the steels. Author (TAB)

N70-16165# Dow Chemical Co., Golden, Colo. Rocky Flats Div.

RELIABLE AND REPRODUCIBLE TECHNIQUE FOR MACROSCOPIC ETCHING OF TYPES 304 STAINLESS STEELS

James F. Capes, James W. Snyder, and Arthur E. Calabra 29 Aug. 1969 3 p

(Contract AT(29-1)-1106)

(RFP-1380) Avail: CFSTI

A reliable procedure is described for macroscopic etching of Types 304 and 304L stainless steel forgings. The method is rapid and 100% reproducible. The surface of the forging to be examined is mechanically ground through a sequence of decreasing grit size on silicon carbide papers, including 600 soft grit. Prior to grinding, the entire forging is masked with a spray lacquer so that after grinding only the surface in question will be attacked by the etchant. Author (NSA)

N70-16191 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.

INFLUENCE OF CHEMICAL COMPOSITION ON THE PRESSURE TIGHTNESS OF CASTINGS IN 3Sn-7Zn-5Pb-1Ni BRONZE

L. E. Kuzin et al May 1969 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (Dzaudzhikau), v. 2, no. 6, 1968 p 121–125 In RUSSIAN and ENGLISH

(NLL-LTI-746-173-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 LL Photocopy Coupon

Since the pressure tightness of a casting may be strongly affected by the composition of the alloy and the solidification conditions, this investigation sought to establish the influence of the amounts of the principal components on the initial and final solidification temperatures of the most common industrial bronzes. The data obtained for 3Sn–7Zn–5Pb–1Ni, 10Sn–2Zn, and 5Sn–5Zn–5Pb bronzes indicate that changing the amounts of the principal components in these bronzes alters their initial solidification

temperature by 10 to 30 C. Thus, altering the chemical composition of these bronzes markedly affects their initial solidification temperature and should be taken into account when choosing pouring temperatures. Altogether, 30 cylindrical castings and 30 disks were produced for each of the compositions investigated. Author

N70-16201 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.

CALCULATION OF THE REACTION BETWEEN CONTROLLED ATMOSPHERES AND ALLOY STEELS

T. N. Vilenskaya et al Apr. 1969 8 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 12, Dec. 1968 p 7–10 In RUSSIAN and ENGLISH

(NLL-LTI-746-124-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL Photocopy Coupon

Experimental data are assessed to determine the effect of alloying elements and controlled atmospheres on carbon steels. Tabulated data on silicon and chromium show an increase and decrease, respectively, in their alloying effect on carbon content. Equations for calculated partial pressures indicate that the proportions of theoretical and practical amounts of controlled atmosphere components are similar for various steels with approximately equal amounts of carbon content or activity. J.M.C.

N70-16244# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

ON OPTIMAL ALLOCATION AND GUIDANCE LAWS FOR LINEAR INTERCEPTION AND RENDEZVOUS PROBLEMS

Michael Athans Sep. 1969 35 p refs Presented at the 1970 Joint Autom. Control Conf. Submitted for publication

(Grant AF-AFOSR-1724-69)

(AD-695836; ESL-P-402; AFOSR-69-2617TR) Avail: CFSTI CSCL 16/2

This paper considers the problem of guiding N interceptors so that they intercept or rendezvous with N targets at the same time T. It is assumed that the interceptors and targets are described by linear time-varying differential equations (deterministic or stochastic). Under certain assumptions both the optimal (static or dynamic) interceptor-target allocation and the guidance of each interceptor for the optimal allocation can be obtained with modest real-time and storage computer requirements. Author (TAB)

N70-16328# Aerojet-General Corp., Sacramento, Calif. Materials Research Lab.

PHASE EQUILIBRIA INVESTIGATIONS OF BINARY TERNARY, AND HIGHER ORDER SYSTEMS. PART 2: EFFECT OF RHENIUM AND ALUMINUM ADDITIONS ON THE METAL-RICH EQUILIBRIA IN THE TITANIUM-MOLYBDENUM-CARBON AND TITANIUM-BIOBIUM-CARBON SYSTEMS

Charles E. Brukl Aug. 1969 33 p refs

(Contract F33615-67-C-1513)

(AD-695063; AFML-TR-69-11-7-Pt-2) Avail: CFSTI CSCL 11/8

The solid state phase equilibria of the metal-rich regions of the Titanium-Molybdenum-Carbon and Titanium-Niobium-Carbon systems with up to 12 At.% Rhenium and 10 At.% Aluminum additions, respectively, have been determined on hot pressed, heat treated, and in part arc melted alloys. The phase equilibria in the metal-rich regions, with these additions, is practically unchanged over that of the ternary Titanium-Molybdenum-Carbon and Titanium-Biobium-Carbon systems; the existence of the large two-phased areas, monocarbide plus metal phases, remains.

Author (TAB)

N70-16330 National Lending Library for Science and Technology, Boston Spa (England).

OXIDATION RESISTANCE OF ALUMINIZED KOVAR ALLOY

P. M. Arzhenyi et al 21 Jul. 1969 6 p refs Transl. into ENGLISH from Zashchita Metal. (Moscow), v. 5, no. 2, Mar.–Apr. 1969 p 226–227 In ENGLISH and RUSSIAN

(NLL-LTI-746-211-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

To study processes occurring in the surface layers of aluminized specimens of Kovar alloy during prolonged oxidation, oxidized specimens were tested for 530 hours in an air atmosphere at 900 C and subjected to chemical microanalysis. Results show that the aluminum content decreased in the diffusion zone owing to burnout and evaporation. The layer thickness of the diffusion zone also changed, but the overall thickness of the zone remained unchanged. Aluminized and unaluminized specimens were then subjected to thermal cycling shock tests consisting of heating for 15 min at 1000 C with subsequent air cooling. The aluminized specimens withstood 150 cycles without rupture, while the unaluminized specimens failed after 12 to 15 cycles. It was also established that the oxidation resistance of aluminized specimens at 900 C is several times that of unaluminized specimens and that the failure of unaluminized specimens occurs chiefly along their grain boundaries. Author

N70-16374# Battelle-Northwest, Richland, Wash. Chemistry and Metallurgy Div.

EFFECT OF STRAIN RATE ON MECHANICAL PROPERTIES OF AUSTENITIC STAINLESS STEELS

R. G. Hoagland Sep. 1969 21 p refs

(Contract AT(45-1)-1830)

(BNWL-1105) Avail: CFSTI

A literature survey of high strain rate effects on the mechanical properties of austenitic stainless steels applicable to fast reactor technology showed little information available. Two general tentative observations were that the flow stress of austenitic stainless steels is more strain rate sensitive above 1000 F than below, and that ductility parameters are reduced at low temperatures by increasing the strain rate while at high temperature, the opposite might be true. Author (NSA)

N70-16422# Naval Research Lab., Washington, D. C. Metallurgy Div.

FRACTURE TOUGHNESS CHARACTERISTICS OF THE NEW WELDABLE STEELS OF 180- to 210-Ksi YIELD STRENGTHS STRENGTHS

P. P. Puzak and E. A. Lange 18 Sep. 1969 31 p refs

(AD-694939; NRL-6951) Avail: CFSTI CSCL 11/6

The yield strength range for steels from 180 to 210 ksi is currently covered by four weldable alloys of the following nominal chemical analysis: 18%Ni-8%Co-3%Mo maraging steel, 12%Ni-5%Cr-3%Mo maraging steel, 9%Ni-4%Co-0.20%C quenched and tempered (Q and T) steel, and 10%Ni-8%Co-2%Cr-1%Mo-0.10%C Q and T steel. Broad ranges of fracture resistance have been reported for these materials based on various fracture tests, and this report presents information for material selection and design guidance by providing an analysis of the interactions between the metallurgical and mechanical parameters that contribute to the fracture resistance of plate products. Definitions of the interaction between the metallurgical and the mechanical aspects are developed with the use of the Dynamic Tear (DT) test and the Ratio Analysis Diagram (RAD). Author (TAB)

N70-16466# National Materials Advisory Board, Washington, D.C.

USAGE PATTERNS FOR TELLURIUM

Aug. 1969 34 p Sponsored in part by Bur. of Mines

(Contract GS-00-DS-(P)-94006)

(AD-693870; NMAB-257) Avail: CFSTI CSLC 8/3

Since tellurium is recovered principally as a byproduct from copper and lead refining, its supply depends greatly on copper and lead production. The United States has been the leading producer and consumer of tellurium in recent years. Production of tellurium by North American refiners is typically in the range of 200,000 to 250,000 pounds per year and consumption in the United States

is also about the same level. Tellurium is used by the rubber, metallurgical, chemical, and electronics industries. It is a secondary vulcanizing agent in the processing of both natural and GR-S synthetic rubber, a carbide stabilizing agent in the production of white cast iron, a machinability additive for carbon steel and copper, and an additive to lead to improve corrosion resistance. Tellurium is also used in thermoelectric and in semiconductor devices. Author (TAB)

N70-16467# National Materials Advisory Board, Washington, D.C.
TRENDS IN USAGE OF GOLD
Sep. 1969 29 p refs Sponsored in part by Bur. of Mines
(Contract GS-00-DS-(P)-94009)
(AD-693869; NMAB-254) Avail: CFSTI CSCL 5/3

The United States production of gold is compared to the production in other free world countries. Developments which may contribute to an increase in domestic production in the near future are cited. Domestic consumption is reviewed by application. Totals for consumption in 1967 and 1968 are in good agreement with those compiled by the Office of Domestic Gold and Silver Operations of the U.S. Treasury Department. Growth patterns have been examined and estimates made on consumption as of 1973. Author (TAB)

N70-16480# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE CARBURIZATION OF FOUR AUSTENITIC STAINLESS STEELS, JUN. – DEC. 1968
James K. Stanley 15 Sep. 1969 38 p refs
(Contract F04701-69-C-0066)
(AD-694511; TR-0066(5250-10)-6; SAMSO-TR-69-281) Avail: CFSTI CSCL 11/6

Four austenitic stainless steels (AISI Types 304 (18Cr-8Ni), 316 (18Cr-8Ni + Mo), 321 (18Cr-8Ni + Ti), and 347 (18Cr-8Ni + Cb)) were carburized in a mixture of methane-hydrogen (1-1/2 vol % methane) up to 25 hr in a temperature range of 730C (1350F) to 1040C (1900F). Carburization occurrence diagrams, i.e., time and temperature at which carburization is observed, for each of the steels are given. Typical carburized structures at 100x and 500x are given. For this work, the carburized layer was considered to comprise both zones. Photographs at 500x show the complexity of the carbide-austenite zone. The carbide formed in all cases was Cr7C3. The rate of carburization, case depth versus time, is given for each of the steels at temperatures from 870C (1600F) to 1040C (1900F). The general form of the curves is parabolic. The carburization rate for titanium-bearing Type 321 is slightly different from that of the other materials. Microhardness (Knoop) traverses were made on several of the steels, and hardness gradients for each of the steels were established. Author (TAB)

N70-16488# National Materials Advisory Board, Washington, D.C.
TRENDS IN USAGE OF MERCURY
Sep. 1969 49 p refs Sponsored in part by Bur. of Mines
(Contract GS-00-DS-(P)-94008)
(AD-693871; NMAB-258) Avail: CFSTI CSCL 5/3

Roughly, one quarter of the mercury consumed in the U. S. goes into electrical apparatus, another quarter to electrolytic cells, and 11 percent to paints. Usage in electrical apparatus, electrolytic cells, paint, and catalysts appears to be growing, uses which now consume two-thirds of the total. No significant new uses for mercury were uncovered. Consumption is predicted to grow from the current rate of 73,855 flasks per year to about 83,544 flasks in 1974-1975. Recent price fluctuations have accelerated the search for substitutes. Only in a few areas do there appear to be technical and economic substitution possibilities; however, the trend is to design to permit the use of less mercury in each device. Author (TAB)

N70-16497# Aerojet-General Corp., Sacramento, Calif. Materials Research Lab.
PHASE EQUILIBRIA INVESTIGATION OF BINARY, TERNARY, AND HIGHER ORDER SYSTEMS. PART 4: THE EFFECT OF MOLYBDENUM AND TUNGSTEN ON THE SUBCARBIDE SOLUTIONS IN THE VANADIUM-TANTALUM-CARBON AND NIOBIUM-TANTALUM-CARBON SYSTEMS
Charles E. Brukl Aug. 1969 57 p refs
(Contract F33615-67-C-1513)
(AD-695062; AFML-TR-69-117-Pt-4) Avail: CFSTI CSCL 11/6

The phase equilibria investigations described in this report are in direct support of Air Force sponsored cutting tool research programs. The results reported here are expected to serve as direct guidelines for the selection of possible candidate cutting tool alloys. Since the making of carbide cutting tools with refractory metal binder phases must depend on high temperature fabrication techniques, it is mandatory that thermochemical equilibria be attained and maintained within the proposed alloys to guarantee the physical and mechanical integrity of the cutting tools. The investigation of the high temperature phase equilibria of possible alloy combinations is, therefore, a prerequisite for the fabrication of even test alloys. Author (TAB)

N70-16599# Akademiya Nauk URSR, Kiev.
IMPROVING THE PROCESS OF TREATING MERCURY ORES
E. I. Baratov, E. N. Malashenko, and A. N. Shcherban *In its* Mining Thermophysics 1968 p 101–108 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

An experimental installation and methodology are described for studying the dynamics of extracting mercury vapors in time as a function of heating temperature and coarseness of the ore to be roasted. On the basis of the results obtained, practical recommendations are made regarding the techniques of processing the mercury ores, which permit elimination of significant losses of ore and a reduction inextraction costs. Transl. by R.B.

N70-16748# Iowa State Univ. of Science and Technology, Ames.
CORROSION OF A LOW ALLOY STEEL IN A SIMULATED LIQUID-METAL-FUEL REACTOR MIXTURE
Roger Lee Suchanek (M.S. Thesis) Mar. 1969 77 p refs
(Contract W-7405-eng-82)
(IS-T-318) Avail: CFSTI

An isothermal, dynamic testing technique was used to investigate the effectiveness of zirconium as an inhibitor to the corrosion of 2-1/4% Cr-1% Mo alloy steel by liquid lead–bismuth eutectic (55.5% bismuth), compounded to simulate the liquid metal medium which would be found in a liquid-metal fueled reactor. The 96-hour tests were conducted in the temperature range of 500 to 900 C. The low alloy steel was resistant to attack up to a temperature of 700 C with extensive intergranular attack occurring above that temperature. Under inhibited conditions in the simulated reactor mixture the low alloy steel was resistant to attack up to 800 C. At this temperature the amounts of iron and chromium removed from the alloy were reduced by factors of 30 and 6, respectively, when compared to the pure eutectic runs. No intergrannular attack was observed at 800 C. This increase in corrosion resistance is thought to be due to the formation of a protective film on the surface of the steel. At 900 C the corrosion resistance of the steel decreased. Metallographic examination of the specimens tested at 900 C showed a finger-like structure on the surface of the metal. The cause of this structure is unknown. Author

N70-16748 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.
THE NATURE OF THE TEMPERATURE ZONE OF

BRITTLENESS IN HEAT RESISTANT ALLOYS OF THE COPPER-NICKEL-BERYLLIUM SYSTEM

V. K. Portnoi et al May 1969 15 p refs Transl. into ENGLISH from Tr. Inst. Met. i Obogashch. Akad. Nauk Kaz. SSR (Alma-Ata), no. 15, 1966 p 47–56 In RUSSIAN and ENGLISH
(NLL-Trans-746-172-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL Photocopy coupons

An investigation is presented to establish if intergranular oxidation that occurs during testing is responsible for the appearance of a deep ductility trough in an alloy system of copper, nickel, and beryllium. Tests were conducted in the as cast condition from 200 to 900 C in air, and in vacuum. It is concluded that: (1) intergranular oxidation during testing is not the principal cause of the temperature zone of brittleness in the range 400 to 800 C, (2) alloys of the system Cu-Ni-Be have a strong tendency to a supersaturated solid solution even at relatively low cooling rates, and (3) the ductility trough is chiefly due to ageing. F.O.S.

N70-16753*# Curtiss-Wright Corp., Buffalo, N.Y.
PROCESS DEVELOPMENT FOR A DISPERSION STRENGTHENED COBALT BASE ALLOY Final Report, 25 Jun. 1968 – 24 Mar. 1969

Bernard H. Triffleman and Keki K. Irani 31 Dec. 1969 100 p refs
(Contract NAS3-11161)
(NASA-CR-72591) Avail: CFSTI CSCL 11F

Co-18Cr-20Ni-4v/o ThO2 powders were prepared by the flash drying selective reduction process starting with an aqueous solution of metal salts containing colloidal ThO2. Procedures were developed for processing the powders into extruded rods of substantially 100% of theoretical density. The best procedure resulted in a rod containing a median ThO2 size of 210 A after a 100 hour, 1205 C stability heat treatment. Author

N70-16832# Metaalinstituut TNO, Delft (Netherlands).
STUDY ON THE EFFECT OF COLD PHOSPHATE TREATMENT AS ELECTROCHEMICAL PROTECTION AGAINST STEEL CORROSION [ONDERZOEK NAAR DE INVLOED VAN KOUDE FOSFATEERBEHANDELING OP HET GEDRAG VAN VERFLAGEN OP STAAL BIJ KATHODISCHE BESCHERMING]

J. W. Boon 15 Oct. 1969 14 p In DUTCH
(M69-608) Avail: CFSTI

Evaluated is the repair of corrosion damages on ship hulls caused by electrochemical attack of sea water and the formation of a calcium-magnesium corrosion layer. Described is a method that requires hot air blasting of the dry ship's hull followed by cold phosphate treatment and rinsing before repainting. The dust caused by the blasting procedure has to be removed by dry brushing to insure strong paint attachment. Transl. by G.G.

N70-16833 National Lending Library for Science and Technology, Boston Spa (England). Development and Research Dept.
THE PROPERTIES OF HEAT-RESISTANT AUSTENITIC MANGANESE-CHROMIUM STEELS FOR SUPERHEATER TUBING

F. Poboril Mar. 1969 15 p refs Transl. into ENGLISH from Neue Hutte v. 13, 1968 p 609–615 and Hutnicke Listy (Prague), v. 23, 1968 p 781–791 In CZECHOSLOVAKIAN and ENGLISH
(NLL-LTI-746-87-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

Heat resistant austenitic steels technology for use in hot rolling of steam pipes and superheater tubes is reviewed. The results of laboratory and extended service tests conducted on superheater coils of austenitic manganese chromium steels are discussed. Findings indicate that these steels possess a stable austenitic structure at the elevated service temperature and that neither austenite decomposition nor brittleness occurs to any appreciable extent. The sole structural change on long-time exposure at service temperature is secondary precipitation of carbides occuring predominently at grain boundaries. This secondary precipitation results in an increase in proof stress and a reduction in plasticity properties, but does not cause any serious embrittlement. Corrosion tests conducted in superheated steam at a pressure of 180 atm with thermal cycling disclosed that the steels exhibited the same corrosion resistance as found under conditions of constant temperature testing. D.L.G.

N70-16899 National Lending Library for Science and Technology, Boston Spa (England).
THEORY OF PERIODIC CONCENTRATION DISTRIBUTIONS IN SUPERSATURATED SOLID SOLUTIONS

A. G. Khachaturyan et al Mar. 1969 14 p refs Transl. into ENGLISH from Kristallografiya SSSR (Moscow), v. 13, no. 1, 1968 p 83–89 In RUSSIAN and ENGLISH
(NLL-LTI-746-93-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A non-linear theory is proposed for periodic concentration distribution in decomposing binary solid alloys. It is shown that periodic distributions correspond to extreme points of the free energy of alloys. Some periodic distributions correspond to metastable states. The period and direction of concentration modulation are determined. Author

N70-16900 National Lending Library for Science and Technology, Boston Spa (England).
DENSIFICATION KINETICS IN THE HOT PRESSING OF METAL POWDERS

E. T. Denisenko et al Feb. 1969 11 p refs Transl. into ENGLISH from Poroshkovaya Met. Akd. Nauk Ukr. SSR (Kiev), v. 8, no. 11, Nov., 1968 p 25–29 In RUSSIAN and ENGLISH
(NLL-LTI-746-99-(9022-401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL Photocopy coupons

An equation is proposed for describing densification kinetics in the hot pressing of metal powders. The equation was derived by allowing for root-mean-square stresses and on the assumption that non-stationary plastic-viscous dislocation-type flow is the limiting process in densification. The densification model proposed was found to describe satisfactorily experimental data on the hot pressing of a 25% Cr–80% Ni alloy powder. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-15560# Army Electronics Command, Fort Monmouth, N.J. Integrated Electronics Div.
DIELECTRIC CHARACTERISTICS OF RF SPUTTERED OXIDE FILMS

I. H. Pratt and J. J. Mc Carthy Sep. 1969 43 p refs
(Contract DA-1H6-62705-A-440-01-21)
(AD-695629; ECOM-3173) Avail: CFSTI CSCL 11/7

Results of a study on the deposition of thin-film dielectrics by RF sputtering are discussed. Source materials were silicon dioxide, aluminum oxide, tantalum oxide, and hafnium oxide, each of which was deposited onto metal electrodes and counterelectroded to complete the metal oxide metal capacitor structures for evaluation purposes. Depositions were conducted normally at 0.002 torr pressure utilizing a triode type sputtering system. Comparative rates of deposition of the dielectric materials ranged from 60 to 225 A/min for the maximum available power. The deposited films were amorphous in structure, although crystallites were dispersed in the

hafnium oxide. Generally, the films displayed electrical and physical characteristics comparable to their counterparts formed by other processes, indicating that the sputtering process has the potential for translating the source materials to the substrates in a form suitable for thin-film dielectric applications. Yield study results are included in terms of non-shortened capacitors and their capability to withstand predetermined dielectric field strengths as a function of electrode areas ranging from 200 to 30,000 sq mil. Author (TAB)

N70-15578# Naval Ordnance Lab., White Oak, Md.
WEIGHT COMPARISON OF HULL STRUCTURAL CONFIGURATIONS FOR MASSIVE GLASS DEEP SUBMERSIBLES
Jack E. Goeller 20 Dec. 1968 41 p refs
(AD-695775; NOLTR-69-2) Avail: CFSTI CSCL 11/2

The report represents the results of a study of three hull configurations for a deep submersible constructed of massive glass with titanium reinforcing rings. The configurations studied were a sphere, a bisphere, and a cylindrical hull with hemispherical ends. Local discontinuity stresses at the joints were considered. It was shown that an optimum length to diameter (L/D) exists for the cylindrical hull which minimizes the weight to displacement ratio. At large values of L/D, the bisphere was shown to be optimum. It was shown that weight-displacement ratio of .5 is feasible for massive glass hulls with an Adiprene shock mitigator on the outside. Author (TAB)

N70-15662# Coating and Chemical Lab. Aberdeen Proving Ground, Md.
DEVELOPMENT OF INTERNAL-COMBUSTION ENGINE LUBRICANTS FOR SUB-ZERO OPERATION Interim Report
Thomas C. Bowen Sep. 1969 23 p refs
(AD-693866; CCL-265) Avail: CFSTI CSCL 11/8

The purpose of the program is to obtain the basic data necessary for revision of the sub-zero engine oil specification in order to satisfy the lubrication requirements of current high performance engines and vehicle automatic transmissions requiring sub-zero oil. Author (TAB)

N70-15669# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
RIBBON REINFORCEMENT OF COMPOSITES
J. C. Halpin and R. L. Thomas Aug. 1969 27 p refs
(AD-695475; AFML-TR-69-33) Avail: CFSTI CSCL 11/4

A clear demonstration of the potential of ribbon-shaped reinforcements in composite materials applications is presented. From a micromechanics analysis, supported by experimental results. Ribbon reinforcement offers superior stiffness properties in the plane of the lamina. The macromechanics analysis introduces the concept of a hybrid composite in which the engineer may combine the outstanding strength properties of fibers with the superior stiffness properties offered by ribbon reinforcements. It is pointed out that the low strength observed for glass-ribbon composites is a consequence of fabrication procedures and does not correspond to the theoretical limiting strength of ribbon reinforcements. The use of ribbon-shaped reinforcements also leads to composites which will have very small isotropic thermal expansion coefficients in the plane of the plate. Thus, ribbon reinforcements provide an attractive means of achieving intermediate to high performance composite possessing dimensional stability. Author (TAB)

N70-15693# Technion - Israel Inst. of Tech., Haifa. Material Mechanics Lab.
LIMITS OF LINEAR VISCOELASTICITY AND YIELD OF A FILLED EPOXY RESIN Scientific Report
Ori Ishai and Sol R. Bodner May 1969 40 p refs
(Contract AF 61(052)-951)
(AD-694088; MML-16; AFOSR-69-2387TR; SR-10) Avail: CFSTI CSCL 11/9

An experimental program was performed to determine the limit of linear viscoelastic response, the onset of yielding, and the condition of gross yielding for a pure and quartz particle filled epoxy resin. The onset of yielding was investigated by a number of different tests, e.g. examination of hysteresis loops, photoelasticity. The tests were performed in both tension and compression over a range of loading times. The limit stresses were found to depend strongly on the loading times. Author (TAB)

N70-15715# Air Force Systems Command, Wright-Patterson AFB, Ohio.
ANALYSIS OF BEAM BENDING EXPERIMENTS OF FIBER-REINFORCED COMPOSITES Technical Report Mar. – Sep. 1968
J. M. Whitney May 1969 27 p refs
(AD-694517; AFML-TR-69-19) Avail: CFSTI CSCL 11/4

The investigation revealed that standard homogeneous isotropic beam theory cannot be used without modification for analyzing data obtained from bending experiments on fiber reinforced composites. Modified equations were obtained by reducing laminated plate equations to laminated beam formulas. For a composite having a large shear coupling compliance, it was shown that a very high ratio of length to width is necessary to validate the one-dimensional assumptions of beam theory. This conclusion was substantiated by experimental data. Author (TAB)

N70-15959 Society of Plastics Engineers, Inc., New York.
REINFORCED THERMOPLASTICS: PROPERTIES, PROCESSES AND USES
15 Oct. 1969 83 p refs Held at Hartford, Conn., 15 Oct. 1969
Copyright. Avail: Issuing Activity

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N70-15960 Liquid Nitrogen Processing Corp., Malvern, Pa.
NEW DEVELOPMENTS IN FORTIFIED THERMOPLASTICS
Roger F. Jones *In* Soc. of Plastics Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 1–8 refs (See N70-15959 05-18)
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The properties of several new materials are briefly described, as determined by investigations of various polymers aimed at extending the boundaries of fortified thermoplastics performance. It is concluded that despite the many commercially available fortified and unfortified thermoplastics, the design engineer is still faced with the fact that their application often has cost–performance parameters beyond the capabilities of compounds already in use. In particular, glass-fiber fortification of a number of materials has extended the cost–performance range where properties such as unusually high resistance to chemical attack and high thermal capacity under load conditions are involved. A.C.R.

N70-15961 Dart Industries, Evansville, Ind. Fiberfil Div.
THE EFFECTS OF FIBER GLASS REINFORCEMENT ON THE FLAMMABILITY PROPERTIES OF THERMOPLASTICS
Kiyo Hattori *In* Soc. of Plastic Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 9–13 (See N70
Copyright. Avail: Issuing Activity

A group of thermoplastic materials in both reinforced and unreinforced form were tested using the three most commonly accepted test procedures to determine flame retardation of plastics. It was found that some of the materials classified as flame retardant failed to pass one or more of the tests, and that the addition of fiber-glass reinforcement enabled several of the samples to pass tests which the unreinforced material failed. In all cases, fiber glass addition reduced dripping in the test bars to some degree. A.C.R.

N70-15962 Potters Bros., Inc., Carlstadt, N.J.
USE OF SOLID GLASS SPHERES IN THERMOPLASTIC POLYMERS
Otto R. Strauch *In* Soc. of Plastic Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 14–19 refs (See N70-15959 05-18)
Copyright. Avail: Issuing Activity

The use of glass-sphere reinforcement to increase the strength properties of plastics is discussed and evaluated. This type of additive is referred to as a reinforcement/filler, since it is non-fibrous yet still has reinforcing properties; it is emphasized that glass spheres offer a combination of advantages not available in other additives currently on the market. Tests indicate that they contribute as a reinforcement/filler for both thermoplastic and thermosetting resins and have an appreciable effect on some physical properties. Compounding and molding are also greatly aided. Viscosity and melt index data indicate the ease of plastics flow, which, regardless of the shape of the mold, facilitates reinforcement of all edges and corners. Because of the size and spherical shape, a smooth surface can also readily be obtained. These characteristics therefore not only yield improved physical properties, but result in substantial savings in cost of materials, processing, and end products. A.C.R.

N70-15964 Wellman, Inc., Boston, Mass.
SPHERE-FILLED NYLON COMPOUNDS PROPERTIES, PROCESSING, ADVANTAGES
Henry J. Wotitzky *In* Soc. of Plastic Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 14–31 (See N70-15959 05-18)
Copyright. Avail: Issuing Activity

The general properties and performance of sphere-filled nylon resins are discussed, with particular emphasis on a compound with the tradename of Well-A-Meld. This material is composed of 25% solid glass spheres and 15% short glass fibers, a combination which yields strength properties equivalent to 30% of those for short glass fiber while still retaining many of the advantages of spheres. The most significant benefits that were realized by the new formula were good flow, uniform and predictable shrinkage, and good surface characteristics. A.C.R.

N70-15965 Hercules Powder Co., Wilmington, Del.
GLASS-REINFORCED POLYPROPYLENE FOR STRUCTURAL APPLICATIONS
L. C. Cessna, J. B. Thomson, and R. D. Hanna *In* Soc. of Plastics Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 32–40 refs (See N70-15959 05-18)
Copyright. Avail: Issuing Activity

The properties that can be obtained for coupled glass-reinforced polypropylene, by direct molding in conventional screw-injection equipment, are described. A dry blend of polymer and chopped glass strands are used; the polymer is commercially available under the tradename Pro-fax PC072. These chemically coupled composites have particularly outstanding time/temperature dependent creep characteristics. Author

N70-15967 General Technologies Corp., Reston, Va.
WHISKERS AND OTHER NEW FORMS OF REINFORCEMENTS FOR THERMOPLASTICS
Robert G. Shaver *In* Soc. of Plastics Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 50–59 refs (See N70-15959 05-18)
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The properties of whiskers and other new forms of reinforcement are described, and the probable processing requirements are indicated, as well as possible areas of application. These fillers include: single-crystal whisker fibers of ceramic materials; carbon fibers having surface growths of whiskers; and hollow carbon microspheres. It is emphasized that the composite technology for the fillers is still undergoing development, and that the optimum manner of use has not yet been fully determined. A.C.R.

N70-15968 Werner and Peleiderer Corp., Waldwick, N.J.
ADVANCES IN COMPOUNDING TECHNIQUES FOR GLASS FIBER REINFORCED POLYMERS
Wolfgang A. Mack *In* Soc. of Plastics Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 60–67 (See N70-15959 05-18)
Copyright. Avail: Issuing Activity

Advances made in the commercial production of fiber-reinforced polymers are reported. There are two basic methods by which fibrous reinforcing materials are incorporated into a commercial polymer: the coating process and the compounding process. The former technique involves continuous feeding of strands of rovings in a cross-die that is surrounded under specified pressure by a molten polymer, followed by heat treatment. The disadvantages of this method are lack of homogeneity of the cut pellet and occasional questionable adhesion of fiber to polymer. In the compounding process, the fiber is blended with the polymer, before or after melting, and is subjected to extrusion compounding in single or twin-screw equipment. Although shorter fiber lengths are obtained, this disadvantage is more than compensated by the greater homogeneity of the product and the versatility of the compounding process as compared with the coating method. A.C.R.

N70-15969 Package Machinery Co., East Longmeadow, Mass.
CUSTOM MATERIAL BLENDING OF GLASS REINFORCED THERMOPLASTICS
Bernie A. Olmsted *In* Soc. of Plastics Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 68–71 (See N70-15959 05-18)
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A commercial method for machine preblending of glass to resin is described and evaluated for use during compounding processes. It was found that in units constructed for preblending, the

percentage of glass to resin is very difficult to control, apparently due to the independent feed ratios of the two systems. Other problems involved in machine blending include static variation in the glass with climatic conditions and the amount of handling, as well as differences in glass dispersion caused by the temperature used on the machine screw and back pressure. Mechanical wear difficulties with the screw-barrel assembly do not appear to be great, but chemical corrosion on the steel remains to be solved. It is concluded that further study into feeding problems and the action on glass within the screw assembly is required before a fully reliable system can be realized. A.C.R.

N70-16970 Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Plastics Dept.

APPLICATION OF THERMOPLASTIC COMPOSITE RESINS BY THE AUTOMOTIVE INDUSTRY

H. H. Goodman *In* Soc. of Plastics Engr., Inc. Reinforced Thermoplastics 15 Oct. 1969 p 72–76 (See N70-15959 05-18) Copyright. Avail: Issuing Activity

Factors affecting the significant increase in use of thermoplastic composite resins in automobile production are identified as: (1) need for materials with greater strength; (2) demand for higher temperature materials for use with high performance engines; (3) need for improved dimensional stability; and (4) cost reduction requirements. The various combinations of resins and additives presently being used for automobile parts are briefly touched upon and examples are given of specific applications. It was estimated in 1968 that there were about 11.5 pounds of reinforced plastics per automobile; by 1975 this figure is predicted to be about 37.0 pounds per car. It is also estimated that by 1975 the dominance of reinforced thermosets in the automotive and truck market will be reversed, and that reinforced thermoplastics will account for two-thirds of the total glass-reinforced components. A.C.R.

N70-16981# Naval Research Lab., Washington, D.C. Surface Chemistry Branch.

THE FUNCTION OF ADHESION PROMOTERS IN ADHESIVE BONDING

Willard D. Bascom 5 Jun. 1969 18 p refs
(Nonr P09-0020)
(AD-694004; NRL-6916) Avail: CFSTI CSCL 11/1

The wet strength of adhesive bonds between resins and glass or metal can be substantially improved by applying adhesion promoters to the glass or metal surface. The most widely used of these adhesion promoters are the organofunctional trialkoxysilanes (RSi(OR)3. Some of the more pertinent research results concerning these silanes have been reviewed in the hope of establishing how they function as finishing agents. Work indicates that these compounds form polysiloxane coatings on the adherend surface. These coatings consist of a strongly adsorbed polysiloxane network along with a more weakly held material consisting of small polymer molecules and unreacted silane. The polysiloxane network exposes a high density of the organofunctional group R- at the air/silane-coating interface. However, the R- groups are not closely spaced, and, in fact, there is some evidence that the coatings can be penetrated by the adhesive resin. Some new approaches are offered for research into the highly complex but exceedingly important area of adhesion promoters. Author (TAB)

N70-16000# Department of Fisheries and Forestry, Ottawa (Ontario). Forest Products Lab.

THE STRENGTH AND DURABILITY OF THICK GLUELINES

E. G. Bergin 1969 26 p refs *Its* Publ. no. 1260
Avail: CFSTI

Test specimens were prepared with four types of adhesives similar to those used in industry for the fabrication of structural glued-laminated timber. Strength tests were made on these adhesives in glueline thicknesses ranging from 0.001 to 0.051 inch in increments of 0.005 inch. The strength of all the adhesives generally decreases with an increase of glueline thickness and casein glue was found to possess very poor gap-filling properties. The effects of long-term aging on adhesives in thick gluelines is under study. Author

N70-16189# Technion - Israel Inst. of Tech., Haifa. Material Mechanics Lab.

SPECIMEN PREPARATION AND PRELIMINARY RESULTS IN THE STUDY OF MECHANICAL PROPERTIES OF FIBER REINFORCED MATERIAL Annual Report, Jan. – Dec. 1968

Jacob M. Lifshitz Wright-Patterson AFB, Ohio AFSC Jul. 1969 95 p refs Submitted for publication
(Contract F61052-68-C-0015)
(AD-694520; MML-15; AFML-TR-69-89-Pt-1) Avail: CFSTI CSCL 11/4

Unidirectional glass/epoxy composite was manufactured and tested to determine effective complex moduli over a time range of about 10 decades and 5 temperatures ranging from 75F to 266F. In the quasi static range only the extensional modulus was determined and in the audio frequency range both extensional and axial shear moduli were obtained. The complex moduli of the epoxy matrix was also determined over the temperature and time range employed in this investigation. The composite extensional modulus was shown to be effectively time and temperature independent. The results were compared to analytical predictions of the moduli. Creep and stress relaxation of the composite material was shown to result in a delayed fracture and this phenomenon was attributed to the viscoelastic properties of the epoxy matrix. Author (TAB)

N70-16243# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN EXPERIMENTAL STUDY OF NON-LINEAR VISCOELASTICITY

Jon M. Jorgensen (M. S. Thesis) Jun. 1969 143 p refs
(AD-694068; GSF/MC/69-3) Avail: CFSTI CSCL 11/10

Styrene butadiene rubber was tested under constant strain-rate loading. The results were compared with stresses predicted by two non-linear viscoelastic constitutive equations - the Lianis Theory and the Bernstein-Kearsley-Zapas Theory. Both theories predicted stresses within 10% of experimental values; the Lianis Theory was generally closer to experimental values. The Lianis Theory was also compared to constant strain-rate loading superposed on a finite, equilibrium step of deformation and to constant strain-rate tests in which the strain rate is changed during the test. The results were comparable to the simple constant-strain-rate test results. Author (TAB)

N70-16332# Royal Aircraft Establishment, Farnborough (England). Engineering Physics Dept.

A TECHNIQUE FOR STUDYING HIGH-VELOCITY DRAWING IN POLYMERS

G. W. H. Stevens and F. C. Bluett London HMSO 1969 33 p refs Supersedes RAE-TR-66262; ARC-30005
(ARC-CP-1061; RAE-TR-66262; ARC-30005) Avail: CFSTI

The principle of elastic relaxation is considered as a technique for drawing polymers at high velocities. The theory is worked out and some tests are described in which skeins of low density polyethylene filaments were drawn using some heat-set terylene webbing as the elastic. These tests, in which polyethylene was drawn at a velocity of about 50 feet per second at a temperature of about 18 deg C, demonstrated that the technique is feasible. Comparison with the theory suggests that the force to draw at this speed is about twice that measured at very slow rates of drawing. Author (ESRO)

N70-16405*# Battelle Memorial Inst., Columbus, Ohio.

FEASIBILITY STUDY ON ISOSTATIC PRESSING OF PYRRONES Final Report

E. J. Bradbury and W. R. Dunnavant [1969] 39 p ref
(Contract NAS1-8245)

(NASA-CR-66858) Avail: CFSTI CSCL 11I

Studies were conducted on the fabricability of pyrrone systems by room-temperature isostatic and conventional compression molding techniques. Although uncured polymer powders could be isostatically compacted, completely cyclized polymers were not compacted at 100,000 psi even with liquid slip agents added. The low bulk density and noncompacting character of finely ground cured and partially cured Pyrrone powder prevented successful metal encapsulation for hot isostatic compaction. However, the capability of the Pyrrones to be compression molded at elevated temperatures by dead-cure procedures was demonstrated and this fabrication method was emphasized. Correlations or conditions required to successfully mold Byrrone pellets to various density and hardness values were developed. It was shown that the molding procedure was complicated by an unfavorable thermal expansion relationship between the polymer and the mold. Compressive stresses appear to be generated in mold restrained polymer during cooling such that serious cracking may occur. Author

N70-16699*# Martin Marietta Corp., Denver, Colo.
SOLAR REFLECTIVE THERMAL CONTROL COATINGS FOR A METEOROID DETECTOR SPACECRAFT, VOLUME 2
Final Summary Report
James A. Cooley [1969] 29 p refs
(Contract NAS1-7043)
(NASA-CR-66874) Avail: CFSTI CSCL 11C

Coatings were formulated using calcia, boron nitride, hafnia, zirconia, and thoria as pigments. Coating or pigment samples were exposed to simulated solar electromagnetic radiation to evaluate the stability of their optical properties to near ultraviolet radiation (2000 to 4000 A). Some effects of doping, heat treating, and cryochemical synthesis of materials were examined. Five percent doped calcia was exposed to 1200 eV hydrogen ions in a fluence equal to a year in a solar wind environment; attempts to synthesize doped and undoped hafnia by cryochemical techniques were unsuccessful. A 5 percent calcia specimen doped with hafnia was sintered at 1700 deg C and exposed to 1200 eV hydrogen ions; some of the specimens were reduced to pigment-sized powders and tested for solar absorption. Results show that hafnia can be made stable, in its optical properties, to space radiation by the calcia additions in solid solution for phase transformation stabilization. Several methods for reducing sintered pellets, synthesizing doped hafnia, and doping hafnia with yttria are recommended. Ultraviolet, combined environment, and other miscellaneous test facilities are also discussed. (For Part 1, see N69-40036). J.A.M.

N70-16773 California Univ., Los Angeles.
A MODEL FOR THE DRYING-HARDENING PROCESS IN CEMENT PASTES
Marc Zdravko Jeric (Ph.D. Thesis) 1968 215 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 69-5317

The problem is classified as a case of transient, coupled heat and two-phase mass transfer in a capillary-porous solid, accompanied by chemical reaction and physical desorption and the corresponding heat and mass sources and sinks. The pertinent properties are defined and approximated by analytical expressions with due regard to their dependence on local moisture content, degree of hydration and temperature. Original expressions are derived for extent of hydration, hydration rate, moisture content at which hydration ceases, heat of liquid-vapor desorption, density, specific heat, thermal conductivity and moisture diffusivity. A phenomenological model is constructed resulting in a pair of coupled non-linear partial differential equations with appropriate initial and boundary conditions. This system of equations is transformed into a finite difference analog and solved on a digital computer for the case of constant environmental temperature and three different relative humidities. Dissert. Abstr.

N70-16780 Tennessee Eastman Co., Kingsport.
COLORING THERMOPLASTICS FOR AUTOMOTIVE APPLICATIONS
R. I. Hawley, J. H. Cheves, and R. O. Hill (Eastman Chem. Prod., Inc.) *In* Soc. of Plastics Engr., Inc. Plastics in the Automotive Ind. Mar. 1969 9 p refs (See N70-16776 05-15)
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The choice of coloring agents and the equipment requirements for coloring plastics are discussed. It is pointed out that the colorant must be stable to sunlight and heat, and resistant to migration and exudation. Laboratory equipment needed by the colorist includes a light source, a spectrophotometer or colorimeter, and a small computer for obtaining reflectance values between sample and trial formulation or concentrations of colorants used for a first sample. The sample matching procedures are described, and emphasis is placed on the human factor requirement as well as the electronic devices. N.E.N.

N70-16781 Allied Chemical Corp., Morristown, N.J. Plastics Div.
SPECIFICATION PROPERTIES vs MATERIAL PERFORMANCE
J. L. O'Toole *In* Soc. of Plastics Engr., Inc. Plastics in the Automotive Ind. Mar. 1969 24 p refs (See N70-16776 05-15)
Copyright. Avail: Issuing Activity

Some common mechanical and thermal tests are investigated by comparing results to the fundamental behavior of plastics under load. Specification tests are discussed with respect to engineering properties. Temperature effects on the properties of various types of plastics as determined by the dynamic modulus test are described. Strength and rigidity are found by stress–strain, creep, and creep rupture tests. Pendulum and drop weight impact tests are used to obtain resistance to impact. A generalized approach to the selection of plastics for load bearing applications and their specification is outlined. N.E.N.

N70-16817*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
CRYOGENIC THERMOCOUPLE TABLES. PART 3: MISCELLANEOUS AND COMPARISON MATERIAL COMBINATIONS
Larry L. Sparks and William J. Hall Jan. 1969 67 p refs
(NASA Order R-45)
(NASA-CR-107749; NBS-9721) Avail: CFSTI CSCL 11G

The thermovoltage, thermopower, and thermopower derivative are presented in graphical and tabular form for: (1) Chromel, copper, platinum and normal silver vs gold-0.02 at. % iron, and (2) copper vs gold-0.07 at. % iron. The experimental temperature range is from 4 to 280 K for each combination. The experimental data have been extrapolated from 4 to 0 K. The thermopower of Chromel vs gold 0.02 at. % iron is higher than that of Chromel vs gold-0.07 at. % iron below approximately 12 K. Copper, platinum, and normal silver vs gold-0.02 at. % iron are reasonably sensitive below approximately 15 K. In this temperature range the pure materials, copper and platinum, have high thermal conductivities and their thermopowers are very dependent upon trace impurities of iron. Thermoelectric comparisons are made graphically for Chromel, Alumel, constantan, normal silver and platinum. The results of these comparisons indicate the degree of noninterchangeability that exists between wires from different manufacturers. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-15508# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
ON SOME MODELS OF THE VON NEUMANN VARIETY Research Report
Michel Truchon Aug. 1969 36 p refs
(Contract Nonr-047-048)
(AD-695768; RR-173) Avail: CFSTI CSCL 5/3

The paper gives a presentation of the von Neumann model and discusses other models of the same variety from the point of view of the efficiency of their solutions. It is shown that some relations of these models are in fact conditions of efficiency.
Author (TAB)

N70-15533# Boeing Scientific Research Labs., Seattle, Wash. Information Sciences Lab.
FAST COMPUTER ANALYSIS OF NONLINEAR SYSTEMS
R. H. Allen and A. F. Fath Sep. 1969 18 p refs
(AD-695497; D1-82-0921; Rept-38) Avail: CFSTI CSCL 12/1

Computer aided design of nonlinear differential systems require many response calculations from the system model derivative of x with respect to time = F(x,u). Many nonlinear systems, especially control systems, can be separated into a stiff linear part and a nonstiff nonlinear part. Fast numerical integration techniques taking advantage of the partitioned from are presented.
Author (TAB)

N70-15542# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
VELOCITY ESTIMATION OF A MOVING FUNCTION USING STOCHASTIC APPROXIMATION
Russell J. Gershman Apr. 1969 28 p refs
(Contract Nonr-266(66))
(AD-695414; Rept-69) Avail: CFSTI CSCL 9/4

There is a class of estimation problems that is not solvable by ordinary means. Consider a function which has a constant velocity with respect to some coordinate system. Assume further that observations of this function are made sequentially and include an additive noise component. If the velocity is known and certain assumptions are placed on the noise, the function can be estimated to any desired accuracy by statistically averaging superimposed versions of the observed functions. If the velocity is unknown, no such simple solution exists. Using the theory of stochastic approximation, this report describes a method which, under certain conditions, can estimate the velocity. Assuming the correlation function of the noise is known and making certain regularity assumptions on the nature of the function, it is shown that the true value of the velocity can be estimated with probability 1 as the number of iterations m approaches infinity, where m is directly proportional to the number of observations. Furthermore, the estimation error in the velocity is shown to be asymptotically normal with a variance that approaches 0 as m approaches infinity.
Author (TAB)

N70-15558# North Carolina Univ., Chapel Hill. Dept. of Statistics.
THEOREMS OF ERGODIC TYPE FOR STATIONARY SEQUENCES WITH MISSING OBSERVATIONS
Robert M. Loynes Aug. 1969 22 p refs *Its* Mimeo Series No. 643
(Contract N00014-67-A-0321)
(AD-694492) CSCL 12/1 Avail: CFSTI

According to the Birkhoff and von Neumann ergodic theorems, the arithmetic mean of the first n variables in a strictly stationary stochastic process converges as n tends to infinity, almost surely and in L superscript 2. If not all variables are available, it is natural to consider the average of the first n available variables, and closely related questions. Such topics, including the analogous situations in continuous time, form the subject of the present paper.
Author (TAB)

N70-15561*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPOLATION FOR FUNCTIONS OF SEVERAL VARIABLES
Joel S. Cohen Aug. 1969 69 p refs
(NASA-TM-X-63784; X-643-69-368) Avail: CFSTI CSCL 12A

Algebraic techniques in interpolation theory are summarized with particular emphasis on the application of these techniques to functions of several variables. The most natural generalizations of the familiar Lagrange formula, Newton divided difference scheme, and Aitken interpolation scheme to functions of several variables are discussed. It is shown that both the Lagrange fromula and Newton formula can be derived from more general theorems on finite dimensional vector spaces. When applied to functions of several variables, these formulae are applicable to arbitrarily located base points as long as the determinants appearing in the denominators are not zero. The Aitken schememe does not have a generalization to arbitrary finite dimensional spaces and an iteration scheme is presented which is valid for certain restricted classes of points.
R.B.

N70-15567# Florida State Univ.,Tallahassee. Dept. of Statistics.
ON EXTENDING THE BRADLEY TERRY MODEL TO ACCOMMODATE TIES IN PAIRED COMPARISON EXPERIMENTS
Roger R. Davidson (Victoria Univ.) Aug. 1969 27 p refs
(Contract Nonr-988(08))
(AD-695468; FSU-M169; ONR-TR-37) Avail: CFSTI CSCL 12/1

The study is concerned with the extension of the Bradley-Terry model for paired comparisons to situations which allow an expression of no preference. A new model is developed and its performance compared with a model proposed by Rao and Kupper. The maximum likelihood estimates of the parameters are found using an iterative procedure which, under a weak assumption, converges monotonically to the solution of the likelihood equations. It is noted that for a balanced paired comparison experiment the ranking obtained from the maximum likelihood estimates agrees with that obtained from a scoring system which allots two points for a win, one for a tie and zero for a loss. The likelihood ratio test of the hypothesis of equal preferences is shown to have the same asymptotic efficiency as that for the Rao-Kupper model. Two examples are presented, one of which introduces a set of data for an unbalanced paired comparison experiment. Initial applications of the test of goodness of fit suggest that the proposed model yields a reasonable representation of actual experimentation.
Author (TAB)

N70-15570# Arizona Univ., Tucson.
PREDICTOR-CORRECTOR SCHEME FOR DIGITAL SOLUTION OF THE PARTIAL DIFFERENTIAL EQUATION FOR ATMOSPHERIC DIFFUSION FROM A LINE SOURCE Technical Report
Edwin W. Titt and Bruce W. Farmer Jun. 1969 64 p refs
(Contract DA-AMC-28-043-66-G23)
(AD-695691; ECOM-66G23-F) Avail: CFSTI CSCL 4/2

The purpose of the report is to extend the range and accuracy of our computer program for the predictor-corrector solution of the partial differential equation of atmospheric diffusion from a line source. The problem is solved in slices proceeding in a downwind direction, each slice requiring a matrix reduction. The equations of the system are the integrated conditions of Green taken over vertical strips of elements. The original equation is written so that the linearized terms carry the main burden, giving a predictor so accurate that little iteration is required. The report introduces the idea of using two approximating nets when the demands of accuracy require a vertical step size too small for a stable process. One is a coarse net for the determination of the matrix, and values of the solution at points of the fine net are computed from Greens formula in an overdetermined fashion using boundary values coming from the coarse solution. In turn, the fine results can be used to improve the accuracy of the accuracy of the corrector for the coarse solution.
Author (TAB

N70-15571# Florida State Univ., Tallahassee. Dept. of Statistics.
SEQUENTIAL ONE-SAMPLE GROUPED RANK TESTS FOR SYMMETRY: BASIC PROCEDURES
Harrison D. Weed, Jr. and Ralph A. Bradley Jul. 1969 42 p refs Sponsored in part by NSF
(Contract Nonr-988(08) Grant NIH 2-T01-GM-00913-07)
(AD-695467; FSU-M167; ONR-TR-36) Avail: CFSTI CSCL 12/1

Wilcoxon presented rank tests for hypotheses on location for both the two-sample and one-sample (paired samples) problems. Wilcoxon, Rhodes, and Bradley developed group sequential rank tests for the two-sample problem using a model under alternative hypotheses proposed by Lehmann and with ranking within groups of fixed size, the groups being taken sequentially. The purpose of the present paper is to present similar sequential extensions of the one-sample, signed ranks test. Author (TAB)

N70-15575# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A NEW METHOD OF GENERATING GAUSSIAN RANDOM VARIABLES BY COMPUTER
Charles M. Rader 18 Sep. 1969 34 p refs
(Contract AF 19(628)-5167)
(AD-695042; TN-1969-49; ESD-TR-69-26623) Avail: CFSTI CSCL 9/2

Many scientific computations require the generation by a computer of a large number of seemingly random numbers with a multidimensional normal (gaussian) probability density function. The note describes a variation of the central limit theorem approach, in which N uniform random variables (r.v.) are transformed into N approximately normal r.v. by a Hadamard transformation. The plan of the paper is to first describe the ideal uniform and normal multivariate densities, second to describe the Hadamard transformation used, third to derive the properties of the transformed variables, and fourth, to consider the properties of the transformed variables after they have been subjected to random sign changes. TAB

N70-15587*# Pittsburgh Univ., Pa. Dept. of Electrical Engineering.
STABILITY THEORY OF NONLINEAR OPERATIONAL DIFFERENTIAL EQUATIONS IN HILBERT SPACES
Chia-Ven Pao (Ph.D. Thesis) 15 Jan. 1969 177 p refs
(Grant NGR-39-011-039)
(NASA-CR-107611) Avail: CFSTI CSCL 12A

The object of this dissertation is to establish some criteria for the existence, uniqueness, stability, asymptotic stability and stability region of a solution of the linear or nonlinear, time invariant or time varying operational differential equations (i.e., equations of evolution) of specific form in Banach spaces and in Hilbert spaces, from which criteria for the same results of a solution of the corresponding type of partial differential equations can be deduced. In the case of linear time invariant equations of evolution, linear semi-group theory is used; and by the introduction of an equivalent semi-scalar product on a Banach space, necessary and sufficient conditions on the linear operator A(t) = A for the generation of a semi-group in a real Banach space are obtained. In the case of nonlinear time-invariant equations, the concept of nonlinear semi-group is introduced. Author

N70-15598# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ON THE INTENSITY OF THE 2P-3D AND 2P-3S LINES OF THE IRON 17 ION IN A RAREFIED PLASMA
I. L. Beigman and A. M. Urnov 13 Mar. 1969 4 p refs Transl. into ENGLISH from Optika i Spektr., (Russian), v. 27, no. 3, 1969 p 380-382
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

Anomalous high line intensity in Fe 17 ion spectrum from the 3s configuration is discussed. The high intensity is due to cascade radiation processes through the 3p and 3d configuration levels, which are not connected optically to the ground state. Exchange effects and electron excitation from the s shells play an essential part in the population of these levels. Direct population of the levels, from dielectron recombination and photo recombination processes, and refinement of the wave functions do not affect the total intensity. The relative line intensities for a transition from a 3d configuration was determined using the relationship between quite complex mechanisms of cascade population of 3s configuration sublevels rather than the 3s configuration binding scheme. J.A.M.

N70-15600# Stanford Univ., Calif. Dept. of Statistics.
A POPULATION PROCESS WITH MARKOVIAN PROGENIES Technical Report
Peter J. Brockwell and Joseph M. Gani 18 Aug. 1969 21 p refs
(Contracts N0014-67-A-0112-0015; N00014-67-A-0112-0024)
(AD-693979; TR-7) Avail: CFSTI CSCL 12/1

A population is considered in which the number of individuals X sub t, t = 0, 1, 2, ..., added to the population in the time interval (t, t+1) is a Markov chain with the non-negative integers as state-space. At the end of each interval one individual is removed from the population, the process coming to a stop when the population size is zero. A method is developed for finding the probability distribution of the time to extinction of such a process for given initial conditions. The model was suggested by a problem in storage theory. TAB

N70-15602# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
TESTS FOR UNIFORMITY AGAINST REGULARLY SPACED ALTERNATIVES Technical Report
Edward D. Rothman Jul. 1969 22 p refs
(Contract Nonr-4010(09))
(AD-695452; TR-119) Avail: CFSTI CSCL 12/1

The paper deals with the problem of testing whether a set of observations is uniformly distributed against the alternative that they equally spaced with error. When the points lie on the real line, they are naturally ordered. TAB

N70-15616*# Brown Univ., Providence, R.I. Center for Dynamical Systems.
ON THE CONTROL OF A LINEAR FUNCTIONAL-DIFFERENTIAL EQUATION WITH QUADRATIC COST
Harold J. Kushner and Daniel I. Barnea Mar. 1969 31 p refs
(Grants NGR-40-002-015; AF-AFOSR-693-67; NSF GK-2788)
(NASA-CR-107696; AD-688234; AFOSR-69-1287TR) Avail: CFSTI CSCL 12A

The paper is concerned with finding the control U(.) which minimizes the quadratic functional V superscript U(X sub T, T) = the integral from T to T of the quantity (X'(S)MX(S) + U'(S)N(S)U(S))DS, where M(S) and N(S) are continuous, M(S) = or > 0, and N(S) > 0 for each S in (0,T). Author (TAB)

N70-15621# Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering.
ADJUSTMENT OF CONTROLLERS
Paul W. Murrill and Cecil L. Smith 17 Sep. 1969 30 p refs
(Contract F44620-68-C-0021; Proj. Themis)
(AD-694043; LSU-T-TR-19; AFOSR-69-2381TR) Avail: CFSTI CSCL 12/1

The report reviews most available material on the subject of tuning (i.e., adjusting the settings of) proportional, proportional-integral, and proportional-integral-derivative controllers. Author (TAB)

N70-15622# Louisiana State Univ., Baton Rouge. Coll. of Engineering.
PREDICTION OF RESPONSE OF FIRST ORDER NONLINEAR SYSTEMS WITH PROPORTIONAL CONTROL

Frank R. Groves, Jr. 17 Sep. 1969 18 p
(Contract F44620-68-C-0021; Proj. Themis)
(AD-694041; LSU-T-TR-17; AFOSR-69-2383TR) Avail: CFSTI CSCL 12/1

The problem of response of a nonlinear system is treated in a generalized manner based on expansion of the nonlinearity in a power series. The method is applied to first order systems with proportional control. Generalized charts for predicting the step function responses of such systems are presented. Author (TAB)

N70-15627# Naval Research Lab., Washington, D.C. Mathematics Research Center.
ON PERIODIC LEFT FACTORS OF MEROMORPHIC FUNCTIONS Interim Report
Fred Gross 11 Sep. 1969 11 p refs
(AD-695774; NRL-6983; Rept-69-1) Avail: CFSTI CSCL 12/1

A study is made of the left factors of mod periodic functions. It is shown that if f(z) is a nonconstant meromorphic function periodic with period beta and if f(p(z)) is periodic modulo an entire function h(z) (p is a polynomial of degree k > 1), then h(z) must be of order = or > k - 1. Furthermore, if f is meromorphic and periodic modulo g(z), rho(g) < k - 1/(k), rho(g) < rho(f), (rho(f) denotes the order of f), and f(p(z)) is periodic mod h, then rho(h) = or > k - 1. This is proved for k = 2, but the result holds in general. Additional results of this type are also established. Author (TAB)

N70-15630# California Univ., Los Angeles. Dept. of Engineering.
COUNTEREXAMPLES AND BOUNDS FOR GRAPHS SOLVABLE WITH FINITE DELAY
A. Paz 3 Oct. 1969 12 p refs Prepared in cooperation with Technion--Israel Inst. of Tech.
(Grant AF-AFOSR-68-1408A)
(AD-695034; AFOSR-69-2565TR) Avail: CFSTI CSCL 12/1

A finite directed labelled graph G with vertices v sub i, i = 1 to i = n and labels (sigma sub i) subscript (sigma sub i epsilon Sigma) is solvable with delay d if for every sequence of labels sigma sub 1,..., sigma sub k one can determine a sequence of vertices v sub (i sub 0)---v sub (i sub k) such that there is a path connecting the vertices v sub (i sub 0)---v sub (i sub k), labeled sigma sub 1 --- sigma sub k and for every j v sub ij is determined by the subsequence sigma sub (j+1) --- sigma sub (j+d) only. The paper presents a family of counterexamples proving a new lower bound for d. A new simple proof is given for a known upper bound for d and a new upper bound for d is given for the case where the sequences of labels are restricted to a regular event. TAB

N70-15638*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
THEMIS SIGNAL ANALYSIS STATISTICS RESEARCH PROGRAM: DEVELOPMENT AND ANALYSIS OF MODIFIED PAIRED COMPARISONS BY USE OF LINEARIZED NONLINEAR REGRESSION
John E. Walsh 19 Oct. 1968 15 p refs
(Grant NGR-44-007-028; Contract N00014-68-A-0515)
(NASA-CR-107691; AD-680261; TR-19) Avail: CFSTI CSCL 12A

The linearized nonlinear regression method has substantial curve-fitting flexibility. It also permits isolation and probabilistic investigation of pertinent effects, and can be used for developing paired comparisons for persons, animals, or plants ('items' of a given type). Here, an item is identified by the values for specified characteristics, and two kinds of 'treatment' (e.g., exposure and nonexposure to radiation) are compared with respect to observed values for a given characteristic. Ideally, two items being compared for treatment effect should be the same with regard to the other characteristics (those not used for comparison). By suitable use of the linearized nonlinear regression model, composite items can be constructed (for given treatment) that are the same with respect to the other characteristics. Modified paired comparisons are obtained on the basis of these composite items. The probability properties of modified paired comparisons can be very heterogeneous, so that special concepts and statistical techniques are needed. Two approaches for development of tests and confidence intervals are given. Some applications involving exposure to radiation are discussed. Author (TAB)

N70-15652*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ALGEBRAIC METHOD OF DIAGRAM REPRESENTATION OF THE STATE OF MULTICOMPONENT SYSTEMS [ALGEBRAICHESKIY SPOSOB IZOBRAZHENIYA DIAGRAMM SOSTOYANIYA MNOGOKOMPONENTNYKH SISTEM]
O. S. Ivanov Washington NASA Jan. 1970 9 p ref Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), no. 1, 1969 p 204-209
(Contract NASw-1692)
(NASA-TT-F-12772) Avail: CFSTI CSCL 12A

A method is described for constructing state diagrams in algebraic form on the basis of experimental data obtained by various methods of physical and chemical analysis. This method is superior to geometric representation when systems with three or more components are involved, or when the state diagram cannot be drawn on a plane surface. A concrete example is given, using the Al-Mg-Zn system. Author

N70-15724# Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering.
IMPROVING CONTROLLER SETTINGS BASED ON OPEN LOOP METHODS
James H. Dube, Cecil L. Smith, and Paul W. Murrill 17 Sep. 1969 17 p refs
(Contract F44620-68-C-0021; Proj. Themis)
(AD-694044; LSU-T-TR-20; AFOSR-69-2380TR) Avail: CFSTI CSCL 12/1

Open loop tuning techniques to determine the values of controller tuning parameters generally use a first-order lag plus dead time model fitted to the open loop process step response (process reaction curve). When the process is of higher order, inaccuracies in the fit of the model will result in inaccurate controller parameters. Therefore it is often found that the response of the process can be improved by tinkering with the parameter adjustments of a controller tuned by these methods. A method is presented in this article which assures near-optimal controller settings beginning with the set of controller parameters based on information obtained from open-loop response methods. Author (TAB)

N70-15733# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
OPTIMAL POLICIES FOR QUEUING SYSTEMS WITH PERIODIC REVIEW
Michael J. Magazine and Michael E. Thomas Aug. 1969 75 p refs
(Contract DAHC04-68-C-0002; Proj. Themis)
(AD-695722; THEMIS-UF-TR-21) Avail: CFSTI CSCL 12/2

The general problem of finding optimal policies for operating queuing systems is investigated in order to determine when to open or close servers so as to minimize cost. The queue size is observed at equally spaced intervals of time and the structure of the optimal policy is determined. The main restriction made, at first, is to limit the model to a single server system. Justification for a form of an optimal policy is given. Then the proofs that this policy is in fact optimal for the finite horizon, and averaging cost criterion are given. Also, conditions for determining that the server should never be closed with customers in queue are presented. The problem is then generalized to allow for a fixed number of servers. Author (TAB)

N70-15781# Purdue Univ., Lafayette, Ind. Dept. of Computer Sciences.
ON THE CONSTRUCTION OF GAUSSIAN QUADRATURE RULES FROM MODIFIED MOMENTS
Walter Gautschi Oct. 1969 27 p refs
(Contract N00014-67-A-0226)
(AD-695818) Avail: CFSTI CSCL 12/1

Given a weight function omega(x) on (alpha, beta), and a system of polynomials (p sub k)(x), k = 0 to infinity, with degree p sub k (x) = k, we consider the problem of constructing Gaussian quadrature rules from modified moments. Classical procedures take p sub k (x) = x, but suffer from progressive ill-conditioning as n increases. A more recent procedure, due to Sack and Donovan, takes for p sub k (x) a system of (classical) orthogonal polynomials. The problem is then remarkably well-conditioned, at least for finite intervals (alpha, beta). In support of this observation, we obtain upper bounds for the respective asymptotic condition number. In special cases, these bounds grow like a fixed power of n. We also derive an algorithm for solving the problem considered which generalizes one due to Golub and Welsch. Finally, some numerical examples are presented. TAB

N70-15783# Wisconsin Univ., Madison. Mathematics Research Center.
A DISTRIBUTION-THEORETICAL APPROACH TO CERTAIN LEBESGUE AND SOBOLEV SPACES
Peter Werner Feb. 1969 85 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-695667; MRC-TSR-964) Avail: CFSTI CSCL 12/1

The main object of the paper is to discuss some basic operations in the Hilbert space L sub 2 and in related Sobolev spaces by using only concepts of distribution theory without referring to Lebesgue integration. Special emphasis will be put on those aspects of the theory which seem to be relevant for applications to partial differential equations and spectral analysis of differential operators. Author (TAB)

N70-15861# Tennessee Univ., Tullahoma. Space Inst.
THE DESIGN AND ANALYSIS OF OPTIMUM SEEKING EXPERIMENTS: LECTURES NOTES FOR A SHORT COURSE ON MATHEMATICAL AND STATISTICAL ANALYSIS OF LABORATORY DATA
Arthur G. Holms 14 Feb. 1969 124 p refs
Avail: CFSTI

Comparisons of experimental strategies for problem solving are discussed. Examples and applications are given for the method of steepest ascents, the method of local exploration, and criteria for good experimental designs. Rotatability, uniform variance, and orthogonal blocking are demonstrated. Designs of experiments as telescoping sequences of blocks are presented. S.M.

N70-15885# RAND Corp., Santa Monica, Calif.
SEARCH FOR A SOLUTION OF THE FIRING SQUAD SYNCHRONIZATION PROBLEM
R. M. Balzer Sep. 1969 30 p refs
(Contract DAHC15-67-C-0141)
(AD-695762; RM-5918-ARPA) Avail: CFSTI CSCL 12/2

The Memorandum describes a series of attempts to solve the conceptually difficult Firing Squad Synchronization Problem. Each of the four attempts described has in common a clerical checking program and a basic backtracking program for searching the solution space. The first two attempts at solution--Serial Definition of Productions and Symbolic Definition of Productions--are non-interactive, entirely computer-directed. The second two-Functional Planning and Constraint Satisfaction--are man-machine symbiotic, designed to allow the human to control and direct the computer search of the solution space. Author (TAB)

N70-15875# Minnesota Univ., Minneapolis. Center for Control Sciences.
SYNTHESIS OF FEEDBACK CONTROLLERS FOR SYSTEMS WITH TIME-DELAY Technical Report
Yogish Alekal 28 Aug. 1969 80 p refs
(Contract AF-AFOSR-1502-68)
(AD-694102; AFOSR-69-2303TR) Avail: CFSTI CSCL 12/1

The investigation develops techniques for synthesizing feedback controllers for systems described by differential difference equations. The study begins with a linear system whose state is not completely available for measurement. A feedback controller is synthesized for such a system which depends on the past history of the available output. The stability of the resulting differential difference equation is analyzed. Then a system with time-delay in its dynamics is considered and the problem of stabilizing the system by means of a feedback controller is discussed. Author (TAB)

N70-15884# Naval Ammunition Depot, Crane, Ind.
USE OF BINOMIAL GRAPHS FOR QUICK AND ACCURATE APPROXIMATIONS TO HYPERGEOMETRIC SAMPLING PROBLEMS
John C. Lannan Aug. 1969 81 p refs
(AD-694006; QETR-2) Avail: CFSTI CSCL 12/1

The hypergeometric probability distribution is the appropriate distribution to use when sampling from a finite population without replacement. Because of the difficulty in calculating probabilities and confidence limits, computers are generally required for quick and accurate results. This paper, however, illustrates an expedient method to quickly and accurately obtain hypergeometric solutions for the more frequent case where less than one-half of the population is to be sampled. The method utilizes binomial graphs generated by a computer plotter. These graphs may also be used conveniently to solve typical binomial confidence problems. Author (TAB)

N70-15911# California Univ., Riverside.
CONJECTURED SET OF EXACT BOOTSTRAP EQUATIONS
Shu-Yuan Chu, P. Kaus, and F. Zachariasen (California Inst. of Tech.) Sep. 1969 24 p refs
(Contract AT(11-1)-68)
(CALT-68-221; CTSL-IR-45) Avail: CFSTI

A set of exact bootstrap equations is conjectured, consisting of two coupled homogeneous equations for the vertex function and the propagator from which any n-legged amplitude can be constructed. One equation is analogous to the vanishing of vertex renormalization constants; the second equation expresses duality. All graphs can be reduced to the simple tree diagram. Amplitudes, if solutions exist, will be crossing symmetric and have at least all the necessary singularities making unitarity plausible but not proved. Author (NSA)

N70-16020# Notre Dame Univ., Ind. Coll. of Engineering.
DISCRETE TIME SYSTEM OPTIMIZATION ON ARBITRARY SETS AND FINITE DIMENSIONAL SPACES
R. Jeffrey and Mark H. Richardson Jun. 1969 73 p refs
(Contract N00014-68-A-0152)
(AD-695074; THEMIS-UND-69-6) Avail: CFSTI CSCL 12/1

As with continuous dynamical system optimization, the basic approaches to optimal control of discrete time systems have their origin in the variational theory of mechanics; Dynamical Programming stemming from the Hamilton-Jacobi Theory and the Discrete Minimum Principle based on the Hamilton Canonical Equations. In contrast to the usual heuristic and computational spirit associated with Dynamical Programming, we give precise necessary and sufficient conditions for optimality of discrete time systems over arbitrary sets, followed by some interesting observations concerning global successive approximations. This is followed by a review of the Discrete Minimum Principle as recently culminated by Halkin, Polak, and others; together with explicit connections between

Bellmans equation and the discrete Canonical equations. A comprehensive development of the asymptotic properties of the discrete optimal linear regulator is then presented. Author (TAB)

N70-16026# Naval Postgraduate School, Monterey, Calif.
A MODEL OF ADMINISTRATIVE CHOICE IN THE SYSTEMS ANALYSIS ENVIRONMENT
Carl R. Jones 10 Jun. 1969 34 p refs
(AD-694920; NPS-55JS9061A) Avail: CFSTI CSCL 5/1

In this paper a mathematical model of governmental decisionmaker's problem of choice from a set of alternative cost-benefit streams is presented. The choice objects, costs, and benefits are considered to be defined physically/socially in time, in space, and by a state-of-nature. The decisionmakers preferences with respect to costs and benefits are represented by a utility index of the standard type except that costs are assumed to be a disutility-causing entity. The set of alternatives from which choice is described is represented by a cost-benefit surface. The decision problem is formulated as a maximization problem. Decision rules are derived. Comparative statics results are given. Author (TAB)

N70-16029# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
RESTRICTION ERRORS FOR LINEAR MODELS (AN AID TO DEVELOP MODELS FOR DESIGNED EXPERIMENTS)
Virgil L. Anderson Dec. 1969 25 p refs *Its* Mimeograph No. 210
Avail: CFSTI

A random error component is introduced into linear models for analyzing data from designed experiments. This error component is called a "restriction error" because it is used whenever a restriction on randomization occurs in the design. The usefulness of this restriction error in randomized complete block designs, nested factorials, and split plot designs is discussed. Accompanying each discussion is an example of an experimental on prosthetic cardiac valves. Further, the restriction error concept is used to look at the controversy regarding a pooled split plot error. Author

N70-16034# Oak Ridge National Lab., Tenn.
KWIC INDEX FOR MATRICES IN NUMERICAL ANALYSIS. VOLUME 1. PRIMARY AUTHORS
A.-J. Householder Sep. 1969 129 p refs
(Contract W-7405-eng-26)
(ORL-4418-Vol-1) Avail: CFSTI

This index contains about 1200 items considered relevant to the numerical treatment of matrices, determinants, and linear systems of equations. It includes books, raports, and periodical articles whose primary authors occur alphabetically between A and J. Subsequent volumes will extend and update the listing.
Author (NSA)

N70-16041 National Lending Library for Science and Technology, Boston Spa (England).
ON THE APPROXIMATE CALCULATION OF CONDITIONAL PROBABILITIES
Ju. E. Katin et al [1969] 21 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), no. 28, 1968 p 41-50
(NLL-M-7762-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A theoretical solution for meteorological forecasting problems is obtained using conditional probabilities. Random values are used to determine normal distribution functions, and the theorem of multidimensional statistical analysis is used to interpret the density of conditional probabilities. Integral expressions are found along with the transformation of limits of integration. A computer program was written to evaluate the determined parameters.
J.M.C.

N70-16046# Navy Underwater Sound Lab., New London, Conn.
NUMERICAL EVALUATION OF CUMULATIVE PROBABILITY DISTRIBUTION FUNCTIONS DIRECTLY FROM CHARACTERISTIC FUNCTIONS
Albert H. Nuttall 11 Aug. 1969 18 p refs
(AD-693991; USL-1032) Avail: CFSTI CSCL 12/1

A method direct numerical evaluation of the cumulative probability distribution function from the characteristic function in terms of a single integral is presented. No moment evaluations or series expansions are required. Intermediate evaluation of the probability density function is circumvented. The method takes on a special form when the random variables are discrete. Author (TAB)

N70-16055# P. E. C. Research Associates, Inc., Louisville, Colo.
TAPE PROGRAM FOR IRREDUCIBLE REPRESENTATIONS OF SPACE AND MAGNETIC GROUPS Final Report
Stanley C. Miller and William F. Love Jul. 1969 26 p
(Contract F44620-68-C-0070)
(AD-694129; AFOSR-69-2460TR) Avail: CFSTI CSCL 20/2

The report is an explanation of the information contained on the magnetic tape which has stored on it the essential contents of the tables contained in the book Tables of the Irreducible Representations of Space Groups and Co-Representations of Magnetic Space Groups. TAB

N70-16056# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mathematics.
DYNAMIC EFFECTS ON ELASTIC SYSTEMS Final Report
George H. Handelman and William E. Boyce 8 Aug. 1969 8 p refs
(Contract AF 49(638)-1655)
(AD-694122; AFOSR-69-2259TR) Avail: CFSTI CSCL 20/12

The paper is the final report for the project, Dynamic Effects on Elastic Systems. The mathematical efforts have followed two major directions: (1) the study of stochastic problems in differential equations and (2) wave-motion and vibration problems in acoustic and elastic media. Author (TAB)

N70-16062# Washington Univ., St. Louis, Mo. Dept. of Systems Mechanical and Aerospace Engineering.
DISTRIBUTED PARAMETER DIFFERENTIAL GAMES
Robert J. Landy (Ph.D. Thesis) Jun. 1969 64 p refs
(Contract AF-AFOSR-1422-68)
(AD-694095; AFOSR-69-2431TR) Avail: CFSTI CSCL 12/2

The dissertation extends some of the results known for lumped parameter differential games to differential games which involve distributed systems. The distributed system is described by a linear second order partial differential equation with appropriate boundary conditions. Simultaneous distributed and boundary controls are considered and all performance criteria involved are quadratic. Two types of differential game are considered, the zero sum game and the nonzero sum game. The saddle point solution for the zero sum game is sought. For the nonzero sum game there are three types of solution which may be of interest. These are the Nash equilibrium, the noninferior, and the minimax. First the closed loop form of each of these solution types is found by using a dynamic programming approach. The partial differential equations which arise in the closed loop formulation are then solved using the normal modes method. Next, the open loop form of the various solution types mentioned above are sought. A variational calculus approach is used to find the necessary conditions for these types of solution. It is found that these open loop strategies are different than the closed loop strategies for the case of Nash strategies, but are the same as the closed loop strategies in the case of the noninferior, the minimax and the saddle point strategies. Author (TAB)

N70-16068# California Univ., Los Angeles. Dept. of Engineering.
STATE DETERMINATION IN DISTRIBUTIVE SYSTEMS WITH SPATIAL AVERAGING SENSORS
Jean Claude Martin 1969 25 p refs

(AF-AFOSR-1547-68)
(AD-694087; AFOSR-69-2365TR) Avail: CFSTI CSCL 12/1

The problem of determining the initial data of a second-order parabolic partial-differential equation defined on a bounded spatial domain from an observation of the solution at a given time T > 0 is considered. The observation is in the form of a weighted spatial average of the solution at time T. Two sufficient conditions for the solvability of this problem are given. The first condition pertains to the form of the integral kernel involved in the observation and the second pertains to the smoothness of the initial data. The case where the observation is expressed in terms of a reproducing kernel of a Hilbert space is treated for the heat equation defined on a one-dimensional bounded spatial domain. Author (TAB)

N70-16069# California Univ., Los Angeles. Dept. of Engineering.
FEEDBACK STABILIZATION OF DISTRIBUTIVE SYSTEMS WITH APPLICATIONS TO PLASMA STABILIZATION
P. K. C. Wang 1 Aug. 1969 13 p refs Submitted for publication
(Grant AF-AFOSR-1547-68)
(AD-694086; AFOSR-69-2364TR) Avail: CFSTI CSCL 12/1

Simple mathematical results are obtained for the feedback stabilization of certain classes of linear distributive systems in the form of a second-order evolutional equation in a Hilbert space. The application of some of the results to the feedback stabilization of a highly conducting, fully ionized plasma is discussed. Explicit forms of feedback controls are obtained for a plasma supported against gravity by a magnetic field and also for a linear pinch. Author (TAB)

N70-16094# Louisiana State Univ., Baton Rouge.
PREDICTION OF RESPONSE OF FIRST ORDER NONLINEAR SYSTEMS WITH TIME DELAY. PART 1: PROPORTIONAL CONTROL
Frank R. Groves, Jr. 17 Sep. 1969 12 p
(Contract F44620-68-C-0021)
(AD-694042; LSU-T-TR-18; AFOSR-69-2382TR) Avail: CFSTI CSCL 12/1

First order nonlinear systems with a time delay are treated in a generalized manner based on expansion of the nonlinearity in a power series. Generalized charts are presented for prediction of optimal tuning for proportional control of such systems. Additional charts give characteristics of the response of the optimally tuned system to step function disturbances. Author (TAB)

N70-16100# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
QUANTITATIVE INTERPRETATION OF STRESS IN KRUSKAL'S MULTI-DIMENSIONAL SCALING TECHNIQUE
W. A. Wagenaar and P. Padmos [1969] 22 p refs
(IZF-1969-15; TDCK-54266) Avail: CFSTI

Some aspects of the quantitative interpretation of stress are discussed on the basis of data obtained with random sets of synthetic dissimilarity matrices. The relation between measurement error and stress is studied. The synthetic dissimilarities are obtained starting from a random configuration of n points (n = 8, 10 and 12) in t dimensions (1 < or = t < or = 3) and adding a fractional error to the interpoint distances. These dissimilarity sets are analysed in m dimensions (1 < or = m < or = 5). The results give an idea of how the stress is influenced by measurement error and the chosen dimensionality of the analysis. In practice the data can be used for the estimation of the true dimensionality of a set of data and of the measurement error. The probability distribution of the stress percentage in m dimensions (1 < or = m < or = 5) is estimated in cases of randomly chosen dissimilarities among n points (7 < or = n < or = 12). The results can be an aid in determining the significance of a multidimensional representation of experimental data. Author

N70-16182# New York Univ., N.Y. Bronx Lab. for Electroscience Research.
THE REMOVAL OF SUPERFLUOUS LINEAR CONSTRAINTS FROM A SIMPLEX TABLEAU
Michael Adamowicz Aug. 1969 29 p refs
(Grant AF-AFOSR-1367-68)
(AD-695837; TR-403-4; AFOSR-69-2658TR) Avail: CFSTI CSCL 12/2

The report is an extension of report AD-682 345. In that report, a method, Method II, was described for detecting constraints made superfluous by one or more other constraints. A procedure was also presented for implementing the method in a modified form of the simplex procedure. This report is concerned with describing and justifying the procedure for eliminating constraints found to be superfluous from a current simplex tableau. Author (TAB)

N70-16200# Technische Hogeschool, Eindhoven (Netherlands). Afdeling der Elektrotechniek.
AN EIGENVALUE ALGORITHM BASED ON NORM-REDUCING TRANSFORMATIONS
Michael Hubertus Cornelius Paardekooper (Ph.D. Thesis) 1969 151 p refs
Avail: CFSTI

An algorithm is described to reduce the Euclidean norm of a real, respectively complex, nonnormal matrix by a plane nonunitary transformation. It is proven that the sequence generated by the successive application of this algorithm converges to the class of normal matrices with the same eigenvalues. A second algorithm is described by which, using unitary plane transformations, an almost normal matrix can be transformed into almost diagonal form. Author

N70-16202# Council for Scientific and Industrial Research, Pretoria (South Africa).
ANALYSIS OF PULSE WIDTH MODULATED SYSTEMS [ANALYZA IMPULSOVYCH SYSTEMU SE SIRKOVOU MODULACI]
Slavomir Suva 1969 15 p refs Transl. into ENGLISH from Automatizace (South Africa), v. 10, no. 6, 1967 p 146 - 150
Avail: CFSTI

The Sylvester rule is used to determine the transition state matrix for evaluating a pulse width modulation system. Sets of differential equations are used to describe open and closed controller systems, accounting for the two transition state matrices. Good agreement is shown between theoretical and measured results. J.M.C.

N70-16326# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
MUTUAL UNCERTAINTY AND PRIOR PROBABILITIES
Rangasami L. Kashyap Jul. 1969 50 p refs
(Grants AF-AFOSR-1776-69; NSF-GK-1970)
(AD-695819; TR-EE69-22; AFOSR-69-2697TR) Avail: CFSTI CSCL 12/1

The paper gives a general method of determining the prior probability function of a variable Lambda using only the prior knowledge which comprises the measurement scheme relating the observables X(1),X(2),... to Lambda, the range of Lambda and the additional knowledge such as the bounds on the expected value of Lambda. The essential idea is that one should not be able to draw any conclusions on the observable random vectors X(1),X(2),... which are not explicitly permitted by the prior knowledge. This leads us to the principle of Maximum Mutual Uncertainty for the determination of the prior probability function in all the cases. In particular, one can derive a rather simple formula for the prior density of a parameter. It is shown that the principle of Maximum Entropy developed by Jaynes for the determination of the prior density of the observable random variable is a special case of the principle of Maximum Mutual Uncertainty. A number of examples have been given to demonstrate the power of the method. Author (TAB)

N70-16355 Vanderbilt Univ., Nashville, Tenn.
IDEALS IN THE MODULAR GROUP RING OF A p-GROUP
Edward Teber Hill (Ph.D. Thesis) 1968 40 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-4637

This paper is concerned with the ideals in the group ring of a finite p-group over the integers modulo p, for p a prime. This study of ideals has three motivations. First, group rings of this type form a large collection of rings so that the study of their ideals is important to the study of rings in general. Second, the conjecture has been made that if two groups have isomorphic group rings, then the groups are isomorphic. This conjecture has been proved for abelian groups and groups of order not more than p to the 4th power. With regard to this conjecture, several ideals are canonically determined by the group ring and can be related to subgroups of the group. Finally, information about a finite p-group may be obtained from the lattice of normal subgroups. For example, the order of the group and the number of generators may be obtained in this way, similarly, the lattice of ideals may be examined to obtain information about the group ring and the group. Dissert. Abstr.

N70-16478 Iowa State Univ. of Science and Technology, Ames.
SINGULAR PERTURBATION TECHNIQUES AND ITS APPLICATION TO A DYNAMIC THERMO-ELASTIC PROBLEM
Thomas Wayne Wineinger (Ph.D. Thesis) 1968 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-4291

The techniques and ideas involved in obtaining asymptotic approximations to solutions of boundary-value problems are discussed. In particular, attention is given to the method of matched asymptotic expansions, which is used when two or more asymptotic approximations is needed throughout the entire region of interest. This is illustrated by applying this scheme to a thermoelastic problem, where the field equations are the coupled thermo-elastic equations. A semi-infinite solid, which is initially undisturbed, is subjected to an instantaneous temperature change at its boundary. Asymptotic approximations of temperature and displacement are obtained where the investigation is restricted to a parabolic curve and a straight line, the latter being near the wave front. Dissert. Abstr.

N70-16490# State Univ. of New York, Stony Brook.
OPTIMAL CONTROL WITH MINIMAX COST
Patrick Edward Barry (Ph.D. Thesis) Aug. 1969 125 p refs
(Grant AF-AFOSR-542-67)
(AD-694097) Avail: CFSTI CSCL 12/1

The subject of this dissertation is the optimal control of systems whose performance is measured by a minimax functional over the state trajectory. The systems are assumed characterized by a set of n first order state equations. Three independent approaches are presented, each of which examines the minimax control problem from an essentially different viewpoint. Utilizing the cost-constraint duality commonly found in optimization problems of this type, the first approach demonstrates the equivalency between the minimax solution and the solution of an optimal constraint problem in bounded state space. In the second approach, a differential minimax cost is developed, allowing the minimax problem to be formulated as a coordinate minimization in the cost-augmented state space (x sub zero,x). This formulation leads to the consideration of a certain set of sub-optimal problems, the solutions of which are shown to converge to the required minimax control. The modifications necessary for the application of standard variational techniques to the reformulated problem are also discussed. The final portion of this investigation is concerned with the strong relationships shown to exist between interval and finite set minimax control problem yielding an alternative procedure for the determination of minimax trajectories. Author (TAB)

N70-16496 Minnesota Univ., Minneapolis.
ON A CLASS OF AUTOMORPHISMS THAT ADMIT OF APPROXIMATION BY PERIODIC TRANSFORMATIONS
Thomas Patrick Schwartzbauer (Ph.D. Thesis) 1968 51 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6644

Automorphisms defined on a normalized non-atomic Lebesgue space, that is, a space isomorphic to the unit interval with Lebesgue measurable sets and Lebesgue measure are considered. By an automorphism we mean an invertible measure preserving point transformation. We first define a notion of approximation by periodic transformations and then develop the properties of automorphisms that admit of this approximation. It is proved that these automorphisms are ergodic, and the conditions are shown under which they have continuous spectrum without being strongly mixing. Next we investigate those invertible measure preserving transformations S which commute with an arbitrary fixed automorphism T which admits of approximation by periodic transformations and show that the image of any measurable set A under the transformation S is determined by the images of various powers of the automorphism T on certain subsets of A. Dissert. Abstr.

N70-16648 California Univ., Los Angeles.
STUDY OF A NEW COMPUTING TECHNIQUE FOR DISTRIBUTED PARAMETER SYSTEMS
Sergio de Julio (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-5303

This dissertation presents the study of a new computing technique for the approximate computation of optimal controls, which avoids the need to solve the differential equation governing the behavior of the system. The technique is shown to be applicable to linear systems whose state space is of infinite dimension. Both the distributed and boundary control problems are examined in an abstract farmework and proofs of existence of optimal controls are given. After having developed an approximation theory, the new computing technique has been applied to two particular examples and the computational results are reported. Dissert. Abstr.

N70-16650 California Univ., Berkeley.
CATEGORIES OF FUZZY SETS: APPLICATIONS OF NON-CANTORIAN SET THEORY
Joseph Amadee Goguen (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-3603

It is argued that inexact concepts can be usefully represented by fuzzy sets. The argument is in two stages: first, a mathematical theorem is proved that any category satisfying certain axioms is equivalent to the category of fuzzy sets with truth values in some completely distributive lattice and secondly, it is argued that the category of inexact concepts satisfies these axioms.Categories are particularly appropriate because they permit discussion of relations between and operations upon concepts without committment as to their internal structure. It is shown that categories of fuzzy sets satisfy the axioms, auxiliary results are accumulated on lattice ordered cctegories, and the theorem is then proved. The material on lattice ordered categories shows that a complete lattice ordered category with images has a good deal of additional structure. Fuzzy sets are non-cantorian in the sense that they do not satisfy all the axioms of traditional Cantorian set theory. Dissert. Abstr.

N70-16677 California Univ., Berkeley.
PERIODIC SOLUTION OF HAMILTONIAN SYSTEMS
William Irving Mc Laughlin (Ph.D. Thesis) 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-3651

This work studies the formal stability of Hamiltonian Systems. The introduction is historical and is intended to put the present work in its proper perspective. Also, a program for future studies

is outlined. Local coordinates are canonically introduced about known periodic solutions and then, using the implicit function theorem, it is shown how to discover new periodic solutions. This method has both practical and theoretical advantages over its near relative the Poincare continuity method. The restricted three body problem R3B is used as an example. The hypothesis of a formal stability theorem of S. P. Diliberto is verified for certain solutions of the first kind in R3B. This theorem allows one to assert the existence of a nested set of tori filling a domain about the periodic solution which constitutes the center of the nest. Dissert. Abstr.

N70-16698 California Univ., Berkeley.
CONVERGENCE, ERROR BOUNDS, SENSITIVITY, AND NUMERICAL COMPARISONS OF CERTAIN ABSOLUTELY CONTINUOUS RAYLEIGH-RITZ METHODS FOR STURM-LIOUVILLE EIGENVALUE PROBLEMS
Olin Glynn Johnson (Ph.D. Thesis) 1968 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-3623

Approximation by piecewise polynomials is considered with application of such subspaces to the problem of computing the eigenvalues of Sturm-Liouville differential operators in the Rayleigh – Ritz manner. A theoretical study of four piecewise cubic subspaces is presented. The Spline and Hermite spaces have been studied by Birkhoff, DeBoor, Wendroff, and Swartz. We add the Farrington, Gregory, Taub space and introduce a new space which we call the Full (piecewise cubic) space. More specifically, we obtain: 1. sufficient conditions for convergence to the eigenvalues by any absolutely continuous method. 2. new computable bounds on the eigenfunctions and their derivatives. 3. computable error bounds for the FGT and Full spaces. 4. new computable error bounds for the Hermite space. 5. theoretical comparisons of these methods based on equal work rather than equal mesh length. 6. sensitivity results for the algebraic problem derived from these methods. A discussion of methods of computing the eigenvalues of the algebraic problem is included. Dissert. Abstr.

N70-16706 Iowa Univ., Iowa City.
INTEGRALS OVER PROTO-RINGS
Wayne Leon Woodworth (Ph.D. Thesis) 1968 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-4292

This dissertation develops an abstract integral for both finitely and countably additive set functions defined on a collection of sets called a proto-ring. It is shown that a proto-ring is a minimal set structure for purposes of most integration theory. Nearly all of the results obtained are derived in such a manner that they hold with no restrictions on the additivity of the set function. Also, in most cases the results obtained do not require an algebra-like structure on the domain of the set functions. Necessary and sufficient conditions are obtained for a function to be integrable, and the analogues to the classical dominated convergence theorem and Radon-Nikodym theorem are shown to hold. The L sub p spaces are defined so as to yield complete spaces even for only finitely additive set functions and to agree with classical L sub p spaces if the set functions are countably additive. It is shown that the development generalizes that of Dunford and Schwartz for finitely additive measures on an algebra of sets and generalizes the development of Bogdanowicz for countably additive set functions on a prering of sets. Dissert. Abstr.

N70-16709 Northwestern Univ., Evanston, Ill.
COMPUTATIONAL METHODS FOR CONSTRAINED MULTISTAGE SYSTEMS
Donald Jack Elzinga (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-5919

Iterative methods are presented for optimizing multistage systems subject to general, non-linear, differentiable constraints. The constraints considered are inequality terminal state constraints and inequality control constraints at each stage. The point of departure for the development of the algorithms is the Kuhn-Tucker necessary conditions which are relaxed and iterated upon. Some new results are given concerning the constraint qualification, which is required for the Kuhn-Tucker conditions to hold, and stronger forms of the constraint qualification are presented which are required to make the computational methods feasible. Two types of algorithms are presented: first-order and second-order. The first-order method employs projection matrices to calculate the multipliers associated with the constraints and is formally equivalent to the gradient projection method. Dissert. Abstr.

N70-16727# Wisconsin Univ., Madison. Dept. of Computer Sciences.
A NOTE ON THE EIGENVALUE PROBLEM FOR SUBLINEAR HAMMERSTEIN OPERATORS
Seymour V. Parter Oct. 1969 27 p refs Sponsored in part by AEC Prepared in cooperation with Los Alamos Sci. Lab.
(Contract N00014-67-A-0128)
(AD-695070; TR-74) Avail: CFSTI CSCL 12/1

Sublinear Hammerstein Equations with nonnegative kernels are studied. An iterative procedure gives positive, maximal solutions. When the kernel is an oscillation kernel, fixed point theorems give the existence of other solutions. Author (TAB)

N70-16737 Pennsylvania State Univ., University Park.
POINT SOURCE GREEN'S FUNCTIONS FOR MONOENERGETIC NEUTRAL PARTICLE TRANSPORT
James Frederick Meyer (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-5573

Expressions for several point source Green's functions are developed which mathematically describe monoenergetic, neutral particle transport in uniform, unbounded media with particle absorption and azimuthally symmetric scattering. Specifically, for media characterized by finite-degree polar-direction-cosine scattering anisotropy, the following Green's functions are found: G1. The scalar flux resulting from a point source with finite degree angular anisotropy. G2. The scalar flux resulting from a monodirectional, point source. A reciprocity theorem of transport theory implies proportionality between this scalar flux and the vector flux resulting from an isotropic, point source in the same medium. G3. The vector flux resulting from a monodirectional, point source. Clearly, these Green's functions are interdependent, e.g., G1 is an angle-moment of G2 which is an angle-moment of G3. Expressions for G1 and G2 are developed in addition to G3 because of the relative mathematical simplicity of the direct angle-moment derivation. Dissert. Abstr.

N70-16752# Case Western Reserve Univ., Cleveland, Ohio.
CONTROLLABILITY OF TWO-LEVEL LINEAR-DYNAMICAL SYSTEMS
Wan-Lin Kiang (Ph.D. Thesis) 1968 232 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 69-9411

The mathematical model of a two-level linear dynamical system is constructed. Controllability of such systems is then defined and studied. The relevance of the model to possible applications is demonstrated by examples. The problem of coordination is the primary concern in the present research. The schemes of coordination are to be conducted by the supremal using image, constraint, goal, and interaction interventions. These terms are defined and their relations with above mentioned mathematical model and controllability of the system are then explored. Dissert. Abstr.

N70-16756 Pittsburgh Univ., Pa.
A NEW LINEAR PROGRAMMING TECHNIQUE FOR THE SHORTEST ROUTE PROBLEM

Mohamed E. Nour (Ph. D. Thesis) 1968 332 p
Avail: Univ. Microfilms: HC $15.10/Microfilm $4.25 Order No. 69-4096

A new matrix technique is developed based on the minimal cost flow algorithm which is modified to achieve quick convergent solutions. The procedure is summarized in four steps designed for both manual and digital computation: 1. Select the source row of the network distance matrix as an initial feasible solution. 2. Proceed in all directions from the source by adding to the links of the initial feasible solution other row links that are directly connected. 3. Search in each column for the minimum distances from the source resulting from the new added links. 4. Repeat steps 2 and 3 till all network nodes are reached. The last feasible solution represents the shortest distances from the source to all other nodes of the network that can be reached from the source by connecting links. The final matrix solution contains the routing of all the routes. This can be tracked by locating the row positions of the minimum distance links that lead successively from the source to the destination node. Dissert. Abstr.

N70-16757 Pennsylvania State Univ., University Park.
A PHASE SPACE FORMULATION OF THE QUANTUM MECHANICS OF ANGULAR MOMENTUM: THE ROTATIONAL WIGNER FUNCTION
Anthony George St. Pierre (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-5590

A new set of generalized coordinates and momenta are introduced: extended Cayley Klein coordinates and momenta. Wigner distribution functions are also constructed and explicitly given for several quantum states. Expectation values are then taken as integrals of Wigner functions with Weyl-corresponding quantities over the Cayley Klein coordinates and momenta. The equation of motion for the distribution function turns out to be the sine (or Moyal) bracket operator of the Weyl-corresponding Hamiltonian and the Wigner function. The Heisenberg picture of the phase space formulation is introduced, and an equation of motion for the body-fixed components of the angular momentum is studied. The thermodynamic properties of a system in equilibrium are investigated. Starting with the Bloch equation for the density matrix in the canonical ensemble, an equation for the ensemble Wigner function is derived. Upon setting appropriate moments of inertia equal to each other, these quantum corrections reduce to those of the symmetrical and spherical tops. Dissert. Abstr.

N70-16767 Colorado Univ., Boulder.
AN INVESTIGATION OF THE EFFECTS OF NON-HOMOGENEITY OF REGRESSION SLOPES UPON THE F-TEST OF ANALYSIS OF COVARIANCE
Percy D. Peckham (Ph.D. Thesis) 1968 375 p
Avail: Univ. Microfilms: HC $16.90/Microfilm $4.80 Order No. 69-4345

One model and its associated analysis which has had wide application in educational and psychological research is generally known as the analysis of covariance. Among the assumptions of the fixed-effects analysis of covariance is the assumption of homogeneous regression slopes. This study was an investigation into the effect of violating that assumption. The issue was investigated by means of computer simulation of comparative experiments of the kind for which the analysis of covariance would ordinarily be used. The investigation proceeded in two phases. In the first phase, the effect of heterogeneous regression slopes under randomized true experimental conditions was investigated. Heterogeneous regression slopes were combined with varying numbers of treatment groups and varying sample sizes to obtain results with both practical and theoretical implications. Dissert. Abstr.

N70-16784 Texas Univ., Austin.
NUMERICAL APPROXIMATION OF THE LAPLACE TRANSFORM BY THE USE OF LEGENDRE POLYNOMIALS
Boyce Lynn Turlington (Ph.D. Thesis) 1968 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-6230

A new method for the numerical approximation of the Laplace transform has been developed and is presented. The method described makes use of a new variable of integration so that the original limits of integration zero and infinity are transformed into other limits of integration −1 and 1. The function whose Laplace transform is desired is expanded in a series of Legendre polynomials. The use of the orthogonality properties of the Legendre polynomials and the interchange of integration and series summation signs allows the numerical approximation of the Laplace transform for real and positive values of the variables. Only a finite sum of the coefficients of the Legendre polynomial expansions is required for any given approximation type studied. Dissert. Abstr.

N70-16785 New York Univ., N.Y. School of Engineering and Science.
AN INVESTIGATION OF ITERATION TECHNIQUES IN FUNCTION SPACES AND APPLICATIONS TO OPTIMAL CONTROL PROBLEMS
Lawrence Bertram Horwitz (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-4566

Recently, two methods have appeared for minimizing a function of N variables. These, known as Davidon's method and the method of conjugate gradients, have much better convergence properties than those of the steepest descent method. However, there has been no extension of the Davidon method to a Hilbert space with an appropriate proof of convergence. This thesis presents an extension of these methods to a Hilbert space with the appropriate proofs of convergence. A constrained minimization problem is also considered. It is shown how the problem of minimizing a functional over elements constrained to a linear subspace (or manifold) of the given Hilbert space may be easily implemented in the Davidon method, and a convergence proof is given for the case when the functional is quadratic. A general control problem is next formulated and an iterative procedure is developed using either the steepest descent, conjugate gradient, or Davidon method. A digital computer program of this formulation is included. Dissert. Abst.

N70-16793 Texas Christian Univ., Fort Worth.
A REPRODUCING KERNEL FUNCTION AND CONVERGENCE PROPERTIES FOR DISCRETE ANALYTIC FUNCTIONS
James Cordell Bolen (Ph.D. Thesis) 1968 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6597

The concept of a discrete analytic function was introduced in 1944. Many properties of discrete analytic functions were developed in 1956. In the first part of this dissertation a reproducing kernel is defined and is shown to have analogous properties of the Bergman kernel for analytic functions. The next part of the paper discusses various types of convergence of discrete analytic functions to a given analytic function defined on a simply connected domain. Finally, it is shown that it is not reasonable to expect the discrete kernels to converge to the Bergman kernel defined on a simply connected domain. Dissert. Abstr.

N70-16795 Colorado State Univ., Fort Collins.
TOPICS IN SURVIVAL TIME DISTRIBUTIONS
Maurice Conrey Bryson (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-5470

A survival time distribution is the distribution, concentrated on the positive real line, of a random variable T which may be regarded as the lifetime of some entity. Certain properties of such distributions are considered. The exponentially-distributed survival

time is of basic importance. It is the unique representation of the survival time of an entity that does not age. Using the exponential lifetime as a base, an investigation is made of the ways in which integration of non-aging components into a system can affect the aging of the system. Application of two aging criteria is demonstrated for a set of empirical survival time data. Dissert. Abstr.

N70-16808 Washington State Univ., Pullman.
GENERALIZED SEQUENCES
Clayton Morris Knoshaug (Ph. D. Thesis) 1968 81 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-3751

The space of entering sequences and the space of generalized sequences are shown to be isomorphic. The subspace of all sequences of bounded support is introduced as the test sequence space on which continuous linear functionals are defined. In this dual space, equality, addition, multiplication by a scalar, convergence, differentiation and the antiderivative of elements are defined. Also, cross product and convolution product for these functionals are defined. Many consequences of the definitions are obtained. Dissert. Abstr.

N70-16810 California Univ., Berkeley.
NUMERICAL STUDIES OF THE BETHE-SALPETER EQUATION
William Bailey Kaufmann (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-3629

After summarizing the application of the Rayleigh-Ritz and Schwinger variational principles to the unequal mass Bethe-Salpeter equation we precent, in graphical and tabular form, the solution of the bound-state problem. The dependence of the coupling-parameter eigenvalue on the exchange mass, external mass ratio, and binding energy is examined in detail for s and p ground states. Mixing of excited levels leading to complex solutions is briefly studied, and some Regge trajectories are also calculated. Scattering phase shifts for unequal-mass scattering were calculated and representative examples given. The fact that certain levels do not appear to contribute to Levinson's theorem is also examined. Finally the foregoing methods are generalized to two-channel systems, and channel phase shifts and inelasticities are computed. Dissert. Abstr.

N70-16814 Minnesota Univ., Minneapolis.
SELECTING A SUBSET CONTAINING THE BEST ONE OF SEVERAL IFRA POPULATIONS
Jagdischandra Kunverlal Patel (Ph.D. Thesis) 1968 41 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6838

Consider k > or = to 2 increasing failure rate average (IFRA) populations pi sub i (i = 1,2,...,k). The IFRA class of populations with nondecreasing failure rate average (FRA) functions gamma (t) was defined. We wish to select a subset (of random size) containing the best one of k given populations according to the unknown ordering of gamma sub i(t) (i = 1,2, k) at some fixed value t = T. Any selection of a subset which contains the population with the smallest gamma (T) is regarded as a correct selection (CS). Three procedures for the above problem are studied. In each case, a reassigned probability P* is specified and constants are determined so that the procedure R is explicit and satisfies the condition regardless of the true unknown gamma-values. Dissert. Abstr.

N70-16830 Maryland Univ., College Park.
SELECTED TOPICS IN INTERPOLATION AND APPROXIMATION BY POLYNOMIALS, ROTATIONAL FUNCTIONS, AND MEROMORPHIC FUNCTIONS
Edward Barry Saff (Ph.D. Thesis) 1968 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-4612

Basic theorems on the convergence and degree of convergence of sequences of meromorphic functions whose finite poles are bounded in number are presented. Applications of the results to approximation by rational functions are included with theorems on overconvergence and some results relating Lipschitz continuity to degree of best rational approximation. A theorem on the degree of divergence of the Taylor expansion of a meromorphic function is extended and used to deduce some basic results on the degrees of divergence and convergence of the polynomials of best approximation to a meromorphic function. Conditions are given for the convergence in higher power norms of the polynomials of best 9th power approximation to a given function. The problem of finding a function f(z) analytic in the open unit disk which takes specified values in certain given points, and also satisfies an integrated continuity condition over the unit circumference is considered. Dissert. Abstr.

N70-16835 Washington State Univ., Pullman.
TOPICS IN STABILITY THEORY
Gary Arthur Hewer (Ph.D. Thesis) 1968 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-3746

Various types of stability theory with emphasis on integral stability are studied. The concept of a quasi-negative function is introduced. A quasi-negative function can be described as one which is almost dominated by an exponential function. Necessary and sufficient conditions for a real-valued function to have this property are given. For a linear differential system, when the system is similar to a triangular system whose eigenvalues are quasi-negative, necessary and sufficient conditions are stated for exponential asymptotic stability. By employing Lyapunov's direct method and quasi-negative functions, some generalizations of known stability and instability theorems are presented. The relationship between integral stability and the limiting behavior of solutions is investigated. Variational techniques to ensure that the integral stability of one system implies the same behavior in the perturbed system are used. Theorems for integral instability are presented. Dissert. Abstr.

N70-16836 Virginia Polytechnic Inst., Blacksburg.
MAXIMUM LIKELIHOOD ESTIMATION OF PARAMETERS USING GROUPED DATA SAMPLES
Jacob Van Bowen, Jr. (Ph.D. Thesis) 1969 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-5521

The method of maximum likelihood was employed to estimate the parameters of the univariate normal distribution when grouped data only are available. Three cases were considered: the variance of the underlying normal distribution known, the mean of the underlying normal distribution known, and the case where both parameters are unknown. The numerical method of successive approximations was studied and was compared to other iterative methods of solution of the likelihood equations. Theorems which establish the convergence of the sequence defined by the method of successive approximations to the unique root of the likelihood equations were developed for the first two cases. In the case where both parameters are unknown, numerical results indicate that a region can be ascertained in which there can be at most one joint solution of the likelihood equations and that, if there is a solution in this region, then it is a point at which the likelihood function has a relative maximum. Dissert. Abstr.

N70-16854# RAND Corp., Santa Monica, Calif.
THE RELATIONSHIP OF CORRECTED R SQUARED AND INCREMENTAL T-STATISTICS
Joseph P. Newhouse Oct. 1969 5 p refs
(AD-694364; P-4206) Avail: CFSTI CSCL 12/1

The purpose of this note is to prove a result, which, although known in oral traditions, is not demonstrated in the econometric

literature so far as the author knows. The result is that the addition of a variable in a stepwise linear regression raises, leaves unchanged, or lowers the corrected R squared as the incremental t-statistic is greater than, equal to, or less than one. Author (TAB)

N70-16871# System Development Corp., Santa Monica, Calif.
CHAINS OF FULL AFLS SCIENTIFIC REPORT
Sheila A. Greibach (Harvard Univ.) 12 May 1969 29 p refs
(Contracts F-19628-67-C-0008; F-19628-68-C-0029; Grant AF-AFOSR-1203-67A)
(AD-693584; TM-738/053/00; AFCRL-69-0293; SR-26) Avail: CFSTI CSCL

If a full Abstract Family of Languages (AFL) L is not closed under substitution, then the result of substituting members of L into L, is not substitution closed and hence L generates an infinite hierarchy of full AFLs. If L1 and L2 are two incomparable full AFLs, then the least full AFL containing L1 and L2 is not substitution closed. In particular, the substitution closure of any full AFL properly contained in the context-free languages is itself properly contained in the context-free languages. If any set of languages generates the context-free languages, one of its members must do so. The substitution closure of the one-way stack languages is properly contained in the nested stack languages. For each n, there is a class of full context-free AFLs whose partial ordering under inclusion is isomorphic to the natural partial ordering on n-tuples of positive integers. Author (TAB)

N70-16873 Carnegie-Mellon Univ., Pittsburgh, Pa.
SIMPLIFICATION OF DYNAMIC SYSTEM MODELS
Edward Underwood Graham (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-3941

This dissertation investigates several aspects of the problem of dynamic system simplification. The time response of linear stationary systems can be expressed as a linear combination of system modes. The dominant or slow acting modes are retained exactly and a simple but good approximation to the fast acting dynamics is derived. In this way, the order of the system is substantially reduced and the simplified model response closely approximates the response of the unsimplified model. In contrast to the model-oriented simplification method outlined above is a solution-oriented dynamic optimization approach. To implement the method developed here, the modeler selects a parametric model form. A parameter identification and elimination scheme is developed which simplifies the model by throwing out those features which do not make a singificant contribution to model performance. Finally, an adaptation of the identification and elimination method is successfully applied to feedback suboptimal control. Given a configuration of candidate feedback controllers, systematic elimination establishes the simplest subset of this configuration that provides near optimum control. Dissert. Abstr.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-15518# Environmental Technical Applications Center (Air Force), Washington, D.C.
A SELECTED BIBLIOGRAPHY ON THE CLIMATE OF THE CENTRAL AMERICAN COUNTRIES
Vincent J. Creasi Sep. 1969 34 p refs
(AD-695482; ETAC-TN-69-7) Avail: CFSTI CSCL 4/2

The bibliography contains 69 climatological references, with annotations, for the Central American Countries. Items are indexed by author and subject matter. All but four of the items were published subsequent to 1959. Author (TAB)

N70-15559# Environmental Science Services Administration, Miami, Fla. Research Lab.
THE ESSA RESEARCH FLIGHT FACILITY: FACILITIES FOR AIRBORNE ATMOSPHERIC RESEARCH
Howard A. Friedman, Frank S. Cicirelli, and William J. Freedman Aug. 1969 98 p refs
(AD-694570; ERL-126-RFF-1) Avail: CFSTI CSCL 4/2

This is the first of a series of reports describing the services of the ESSA Research Flight Facility (RFF), an airborne research organization that provides worldwide services to the scientific community. The first volume gives a brief history of the RFF and describes the RFF aircraft, logistical support requirements, navigational and operational practices, and communications capabilities. Typical flight patterns and aircraft capabilities are also described as an aid to researchers in planning particular experiments or data collection programs. Author (TAB)

N70-15633# Environmental Science Service Administration, Asheville, N.C. National Weather Records Center.
CLIMATOLOGICAL SUMMARIES. VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 38: SEATTLE, WASHINGTON, SEATTLE–TACOMA INTERNATIONAL AIRPORT
Jun. 1969 32 p Prepared for FAA
(Contract FA-67-WAI-129)
(RD-69-22-Vol-38) Avail: CFSTI

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Seattle airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N70-15686 National Lending Library for Science and Technology, Boston Spa (England).
WINTER CIRCULATION AND METEOROLOGICAL CONDITIONS IN THE FAR EASTERN SECTOR IN TWO EPOCHS
A. S. Chaplygina 20 Jul. 1969 47 p refs Transl. into ENGLISH from Akad. Nauk, Mezhd. Geofiz. Kom., Rez. Issled. po Mezhdunar. Geofiz. Progk., Art. Met. Res. (Moscow), no. 13, 1968 p 50–81
(NLL-M-7736-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .5 NLL photocopy coupons

A statistical analysis of the frequency of intense anomalies of the monthly air temperature means showed that in the winter months of the meridional epoch, 1899–1923, in the Far Eastern sector of the northern hemisphere (120–170 deg E) the mean temperature was more often considerably below the long term mean while in winter in the zonal epoch, 1924–1953, monthly means considerably above normal showed the highest frequency. A study of the special features of the circulation conditions over the whole of the northern hemisphere in the winters of both epochs enables us to suggest that changes of the temperature regime are caused by changes in the position and intensity of such principal centers of action in the atmosphere as the polar, Asiatic and North American anticyclones and the Aleutian depression. To confirm this, a detailed analysis was made of the circulation conditions and specific synoptic processes leading to such marked departures of the temperature from the long term means. Author

N70-15704# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
OBJECTIVE ANALYSIS OF A TWO DIMENSIONAL DATA FIELD BY THE CUBIC SPLINE TECHNIQUE Scientific Report

Michael J. Fritsch (M.S. Thesis) Aug. 1969 42 p refs *Its* Atmospheric Sci. Paper No. 143
(Contract F19628-68-C-0104)
(AD-694091; AFCRL-69-0342; SR-1) Avail: CFSTI CSCL 4/2

A procedure to use the Spline interpolation technique on an arbitrarily prescribed two-dimensional data field is described. In order to use this technique it is necessary to obtain an initial approximation to the data at the grid points. This is achieved by fitting spherical surfaces to the data. Bi-directional Spline interpolation was then applied repeatedly on the grid point estimates of the data to produce convergence to the true surface. The Spline interpolation technique and another objective analysis technique developed by Gilchrist and Cressman are tested against an exact solution and the resulting analyses are compared. Real temperature, geopotential height, and wind data for various pressure surfaces are analysed by the Spline method and the results are compared to the subjective analyses of the same data. Author (TAB)

N70-15714# Air Force Cambridge Research Labs., Bedford, Mass.
WORLD FREQUENCY OF HIGH TEMPERATURE
Paul I. Tattelman, Norman Sissenwine, and Robert W. Lenhard, Jr. Aug. 1969 37 p refs
(AD-696094; AFCRL-ERP-305; AFCRL-69-0348) Avail: CFSTI CSCL 4/2

In order to determine the highest surface air temperature at which standardized military materiel should be able to operate, world maps showing frequency of exceedance of various high temperatures are needed. Ideally these should be prepared by plotting probabilities of exceedance from frequency distributions of hourly temperatures, but such frequency distributions are not available on a world wide basis. An index was devised that could be related to temperatures exceeded 1, 5, and 10% of the time. The index is the sum of the mean and the mean daily range of temperature for the warmest month. The three relationships obtained were applied to estimate and map temperatures exceeded with the stated frequencies for 450 of the warmest locations of the world. Conclusions are drawn as to the interpretation of various temperature limits. Author (TAB)

N70-15717# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A STUDY OF THE STRUCTURE AND BEHAVIOR OF JET STREAMS OVER THE WESTERN UNITED STATES
Peter F. Lester Jun. 1969 124 p refs
(Grant ESSA-E-10-68(G))
Avail: Issuing Activity

The need for jet stream research over the mountainous western United States is stressed. A survey of the literature yields evidence which suggests that jet streams in that region may differ markedly from presently accepted models in both structure and behavior due to the influence of the orography. It is suggested that satellite and conventional data should be combined to investigate the detailed structure of individual jet streams and that a large sample of maximum wind data should be statistically examined to reveal the climatological characteristics of jet streams near the mountains. Four case studies and a systematic sample of five years of maximum wind data for Spring have been analyzed to test the proposed approach. Case study results quantitatively indicate that the jet stream environment is conducive to widespread lee wave activity. When wave clouds are present, their location and dimensions as observed by satellite appear to be related to the jet stream structure. The dimensions of terrain-induced clear areas in jet stream cirrus are also indicative of that structure. Author

N70-15761 National Lending Library for Science and Technology, Boston Spa (England).
CIRCULATION CONDITIONS IN THE VALLEY OF THE MALAJA ALMATINKA IN WINTER
V. P. Kelberg 20 Jul. 1969 40 p refs Transl. into ENGLISH from Tr., Ukr. Nauch.-Issled. Gidrometeorol. Inst. (USSR), no. 29, 1967 p 79–99
(NLL-M-7792-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

Atmospheric circulation and synoptic conditions from the mountain valleys and foothill zones of Malaja Almatinka are given. Wind profiles indicate a direct relationship between snow cover and circulation characteristics. The frequency of calms was shown to be dependent on synoptic conditions especially where anticyclonic situations were accompanied by calm in the lower troposphere. Lapse rate is considered in terms of the inversion and the isothermal regime in the surface layer up to 500 mb. Radiosonde data indicate that inversions occur often in the surface layer. Lapse rate is also shown to be related to a high frequency of calms. J.M.C.

N70-15763# Environmental Science Services Administration, Silver Spring, Md. Environmental Data Service.
CHARACTERISTICS AND PROBABILITIES OF PRECIPITATION IN CHINA Technical Report
Augustine Y. M. Yao Sep. 1969 38 p refs
(ESSA-TR-EDS-8) Avail: CFSTI

Availability, distribution, and length of record of Chinese climatological data, and skewness and variability of monthly precipitation are discussed. The K – S tests for goodness to fit show that the sample values (monthly precipitation) and the theoretical distribution curves (gamma distribution) are not significantly different at the 20-percent level. Distributions of monthly precipitation probabilities of selected amounts of precipitation (zero to trace, and 1, 3, 7, 10, and 14 inches) are described, and depicted on precipitation probability charts. Author

N70-15767# Weather Bureau, Silver Spring, Md. Weather Analysis and Prediction Div.
SIZE OF TORNADO WARNING AREA WHEN ISSUED ON BASIS OF RADAR HOOK ECHO
Alexander Sadowski May 1969 32 p refs *Its* Notes to Forecasters No. 10
(ESSA-TM-WBTM-FCST-10) Avail: CFSTI

Documented radar hook echoes and storm data for the years 1953 – 1966 were studied for clues to improve the tornado warning service. In 29 out of 33 instances, for which data were adequate for comparison, tornadoes occurred near the distal end or knob of observed radar hook echoes. The diameter of a circle which best fits or describes a radar hook echo and the speed and direction of movement of the parent storm cell for one hour are used to determine the size and limits of the tornado warning area. The method is advanced as a proposal for reducing the size of the tornado warning area when issued on the basis of an observed radar hook echo. Author

N70-15968 National Lending Library for Science and Technology, Boston Spa (England).
SYNOPTIC PROCESSES PRECEDING MUD FLOODS OF SHOWER ORIGIN IN THE BASINS OF BOLSHAJA ALMATINKA AND MALAJA ALMATINKA
T. A. Esarkepova [1968] 16 p refs Transl. into ENGLISH from Tr. Nauch.-Issled. Gidromet. Inst. (Alma-Ata), no. 29, 1967 p 26–35
(NLL-M-7756-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Heavy shower activity causing mud-flows in both basins between 1921 to 1954 was found to result from cold intrusions and the intense warm advection to the mountains of the Zailijskij Alatau. These intrusions of cold air masses are atypical and distinguished by sharply marked meridional flow, cold advection deep into the southern regions of Central Asia on the eve of the intrusion, and large gradients in the upper frontal zone at 500 mb. The cold air masses followed three paths: southward or

south-eastward or southward in the north of the European U.S.S.R., then, suddenly changing to eastward. Zero isotherm height over the basin area preceding the mud-flow forming shower was 4 to 5 km in May and June, and more than 5 km in July. Heavy rain is a necessary but not sufficient condition for mud-flow formation as demonstrated by 19 cases of precipitation exceeding 60 mm in the Malaja basin between 1936 and 1962 but only four mud-flows. M.H.E.

N70-15989 National Lending Library for Science and Technology, Boston Spa (England)

THE LONG-TERM VARIATION OF INTENSITY OF SOLAR RADIATION ACCORDING TO OBSERVATIONS OF ACTINOMETRIC STATIONS

Z. I. Pivovarova [1969] 39 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 233, 1968 p 17 - 37
(NLL-M-7768-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

A study was conducted of the changes in the intensity of solar radiation measured at the earth's surface to aid in estimating fluctuations in the transparency of the atmosphere. Observations from eight geophysical observatories in the USSR and from four pyrheliometer observatories in the northeastern United States were compared. All values of direct radiation measured up to 1957 were recalculated to eliminate inhomogeneity of the series of data from the different stations. R.B.

N70-15990 National Lending Library for Science and Technology, Boston Spa (England).

DYNAMICAL TURBULENCE IN THE ATMOSPHERE

A. S. Monin [1969] 52 p refs Transl. into ENGLISH from Izv Akad. Nauk SSSR, Ser. Geofiz. (Moscow), v. 14, 1950 p 232 - 254
(NLL-M-7674-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

Using the equation of turbulent energy balance, the wind distribution and the coefficient of turbulent viscosity were determined simultaneously for the entire boundary layer. Very large-scale roughness is characteristic of processes which extend throughout the boundary layer and eddy diffusion is important only at very great heights. Since the thermal inhomogeneity of the atmosphere can distort results considerably, the given results can only be compared with climatological data. R.B.

N70-16076 National Lending Library for Science and Technology, Boston Spa (England).

ON THE PROBLEM OF THE EXTENSION OF A MOUNTAIN-VALLEY CIRCULATION INTO A FOOTHILL VALLEY

A. I. Holkin 25 Sep. 1969 11 p refs Transl. into ENGLISH from Nauch.-Issled. Gidromat. Inst. (Alama-Ata), no. 29, 1967 p 114 - 117
(NLL-M-7786-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Wind speed and direction measurements were made in the Alma-Ata region to determine the frequency of circulation in mountain valleys. Synoptic observations were categorized according to stable, unstable, and frontal weather. Using these synoptic conditions frequency spectra were drawn. Results indicate that mountain-valley circulation is most dominant during stable weather and the early morning hours when the frequency of valley breezes reaches 60%. An intense katabatic flow developed in the late afternoon during unstable and frontal weather conditions. Southerly and northeasterly wind are the dominant wind directions responsible for the valley breezes. J.M.C.

N70-16080 National Lending Library for Science and Technology, Boston Spa (England).

A TECHNIQUE FOR DETERMINING HOURLY VALUES OF THE RADIATION BALANCE INDIRECTLY

V. P. Gagua [1969] 18 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 233, 1968 p 49 - 57
(NLL-M-7757-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

A comparison of the measured and calculated mean monthly values of radiation balance has shown that there is excellent agreement between them. For the hourly and daily values the relative error of the calculated data does not exceed 10-15% of the measured values. As a result of this study, a method of indirectly determining the diurnal variation of the radiation balance is suggested. This method may be utilized throughout the year in regions where there is virtually no snow cover and where the albedo of the underlying surface is reasonably constant. In temperate latitudes it may be used during the period when the underlying surface is free from snow. Author

N70-16120# National Weather Records Center, Ashville, N.C.

CLIMATOLOGICAL SUMMARIES. VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 20: LOS ANGELES, CALIFORNIA, INTERNATIONAL AIRPORT Final Report

Jun. 1969 33 p
(Contract FA-67-WAI-129)
(AD-694000; FAA-RD-69-22-Vol-20) Avail: CFSTI CSCL 1/5

The report consists of climatological data for Los Angeles International Airport, Los Angeles, California. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation. Author (TAB)

N70-16121# National Weather Records Center, Ashville, N.C.

CLIMATOLOGICAL SUMMARIES. VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 21: LOUISVILLE, KENTUCKY, STANDIFORD FIELD Final Report

Jun. 1969 32 p
(Contract FA-67-WAI-129)
(AD-694539; FAA-RD-69-22-Vol-21) Avail: CFSTI CSCL 17/7

The report contains climatological data for Standiford Field, Louisville, Kentucky. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation at Standiford Field, Louisville, Kentucky.

Author (TAB)

N70-16122# National Weather Records Center, Ashville, N.C.

CLIMATOLOGICAL SUMMARIES. VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 22: MIAMI, FLORIDA, INTERNATIONAL AIRPORT Final Report

Jun. 1969 33 p
(Contract FA-67-WAI-129)
(AD-694001; FAA-RD-69-22-Vol-22) Avail: CFSTI CSCL 1/5

The report consists of climatological data for Miami International Airport, Miami, Florida. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation. Author (TAB)

N70-16185 National Lending Library for Science and Technology, Boston Spa (England).

AIR-TEMPERATURE INVERSION FREQUENCY AT KRYNICA-ZDROJ (1956 - 1960)

H. Boniecka-Zoicik 25 Sep. 1969 17 p refs Transl. into

ENGLISH from Przeglad Geof. (Warsaw), no. 8, 1963 p 37-44
(NLL-M-7781-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The frequency of air-temperature inversion at Krynica-Spa for the five year period from 1956 to 1960 was investigated. The results are presented in tabular form showing the frequency of this phenomenon, its intensity, and its duration. Correlations between air-temperature inversion and magnitude of cloud cover, wind velocity, and fog frequency, are also shown. It is pointed out that occurrences of the phenomenon take place on about 60 percent of the days throughout the year, in all seasons, with maxima in August and September, and at all hours of the day, with highest frequency in the morning hours. Author

N70-16193# Institut Royal Meteorologique de Belgique, Brussels. Inst. d'Hygiene et d'Epidemiologie.
ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX] Monthly Bulletin, Mar. 1969
1969 22 p In FRENCH and DUTCH
Avail: CFSTI

Tables are given of the sulfur dioxide and smoke quantities (air pollution) measured at different weather stations in Belgium in March 1969. A brief description is given of the air sampling apparatus. ESRO

N70-16197# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS [OBSERVATIONS SYNOPTIQUES] Monthly Bulletin, Oct. 1968
1969 29 p In FRENCH and DUTCH
Avail: CFSTI

Synoptic data from different Belgian weather stations during October 1968 are tabulated. ESRO

N70-16199# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 37: CALIFORNIA SAN FRANCISCO INTERNATIONAL AIRPORT Final Report
Jun. 1969 32 p refs
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-37) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the San Francisco, California International Airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N70-16212# Honeywell, Inc., St. Paul, Minn. Research Dept.
AIR-LAUNCHED WINDSONDE Final Report, 15 Jun. 1966 - 30 Jun. 1969
Stephen F. Rohrbough and Lyle E. Koehler 28 Aug. 1969 87 p
(Contract AF 19(628)-6082)
(AD-694498; Rept-12042-FR1; AFCRL-69-0375) Avail: CFSTI CSCL 4/2

An air-dropped, instrumented sonde for measuring wind profiles has been developed. It requires no tracking, no aircraft loitering, and is relatively inexpensive. The instrument is essentially an arrow-shaped sonde that remains at zero angle of attack during descent. Wind direction and velocity are inferred from orientation of the sonde axis with respect to vertical and magnetic north. An air-bearing gyroscope and a magnetometer are used to measure this orientation. Performance of the sonde has been verified through both balloon-launched and aircraft-launched test series. Balloon launchings provided preliminary test results indicating that the concept was viable and also indicating areas of improvement required to eliminate intermodulation problems within the sonde electronics. Aircraft launchings provided wind data that compared favorably with concurrent radiosonde measurements. Author (TAB)

N70-16245# Institut Royla Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Sep. 1968 [OBSERVATIONS SYNOPTIQUES]
1963 23 p In FRENCH and DUTCH
Avail: CFSTI

Synoptic data from different Belgian weather stations during September 1968 are tabulated. ESRO

N70-16327# Space/Defense Corp., Birmingham, Mich.
AUTOMATED WEATHER BUOY INCORPORATING AN UPPER AIR SOUNDING ROCKET DATA SUBSYSTEM Final Report, 3 Apr. 1967 - 30 Nov. 1969
Michael Brian 19 Sep. 1969 59 p
(Contract N00014-67-C-0479)
(AD-694061; TR68-116) Avail: CFSTI CSCL 4/2

The program objective was to produce a fully automatic weather station, capable of operating for long periods untended; the sensed data to include surface and upper atmosphere parameters, similar to the data currently being supplied by the manned weather stations throughout the world. A U.S. Navy NOMAD buoy, currently operating as a surface weather station, was modified to include a cluster of sounding rockets. Following each surface weather transmission a rocket is launched carrying a rocketsonde which commences transmissions at apogee. The data is relayed, via the buoy, to monitoring shore stations. The work reported covers the development of a prototype version. The parameters of wind speed and wind direction for the upper atmosphere were not included during this phase of the program. Author (TAB)

N70-16416 National Lending Library for Science and Technology, Boston Spa (England)
WIND PROFILES WITH LOW CLOUD BELOW 300 m
G. B. Mashkova [1968] 9 p refs Transl. into ENGLISH from Tr. Inst. Prik. Geor. Glav. Uprav. Gidromet. Sluzh. (Moscow), no. 10, 1967 p 39-43
(NLL-M-7764-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Air temperature, wind speed, and wind direction observations made on a 300-meter meteorological mast were studied. Three types of wind profiles were noted. In order of decreasing frequency they are one with a smooth rise of wind speed with height, a second with a speed maximum at one height, and a third with a complicated, often S-shaped variation of wind speed with height. No temperature inversion was found. The most and least stable stratifications were determined to be with the first type of profile. The most stable is associated with a considerable rise of wind speed over the whole 300 m layer, and the least stable with a rise only near the ground. N.E.N.

N70-16470 National Lending Library for Science and Technology, Boston Spa (England)
SYNOPTIC MODELS USED IN THE FORECAST SECTION OF THE NATIONAL METEOROLOGICAL SERVICE. RESULTS OF THEIR APPLICATIONS. CURRENT STATE OF THE NATIONAL INVESTIGATIONS IN THIS FIELD
L. R. Rivera 25 Sep. 1969 65 p refs Transl. into ENGLISH of San Salvador, Serv. Meteorol. Nacl. Publ. Tech. No. 9
(NLL-M-7798-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 6 NLL photocopy coupons

Synoptic models are presented with several examples showing their degree of applicability. The model of instability waves is the most useful one and a method of forecasting these waves using stream line and isotach analysis is explained. Analysis of the climatology, troughs and easterly waves, high pressure cold fronts

and ridges, and the influence of the Pacific on these are presented. The intertropical convergence zone, secondary and temporal cyclonic disturbances are discussed. Author

N70-16643# Paris Univ. (France). Lab. de Physique de l'Atmosphere.
OZONE AND METEOROLOGICAL FORECASTING [OZONE ET PREVISION METEOROLOGIQUE]
J. P. Bancarel and F. Calvo Canales (Valencia Univ.) *In* CNRS Proc. of Symp. on Atmospheric Ozone May 1969 p 139–305 refs In FRENCH; ENGLISH summary (See N70-16604 05-13)
Avail: CFSTI

An analysis of the ozone soundings made at the Val-Joyeux scientific station since 1964 shows relations between atmospheric ozone vertical profiles and the meteorological situation at the surface four days after sounding. The number of ozone concentration maxima, their altitudes, and respective intensities are decisive elements for the classification in five groups, each group being connected to a characteristic meteorological situation. The equipment was adapted to the exigencies of the forecast: a telemetry system allowing the quick process of data by computer was realized. Author (ESRO)

N70-16733 National Lending Library for Science and Technology, Boston Spa (England).
LONG-TERM FLUCTUATIONS IN THE GENERAL CIRCULATION OF THE ATMOSPHERE AND IN CLIMATE AND THEIR RELATIONSHIP TO THE MAIN LAWS OF THE PLANETARY CIRCULATION
B. L. Dzerdzeevskij 20 Jul. 1969 32 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Mezhd. Geofiz. Kom. (Moscow), 1968 p 252–272
(NLL-M-7730-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

Periodic climatic oscillations and their role in long-range weather forecasting were evaluated. Widely known large-scale circulation processes were investigated with an aim of classifying them into small groups representing generalized characteristics of individual processes. Frequencies of the standard processes and their duration were used as material for statistical processing. Calculations were made for the hemisphere as a whole and for each of six sectors with data for months, seasons, and years being used in all cases. Two circulation and climatic periods (epochs) in the twentieth century were identified. Meridional circulation predominated in the first and zonal circulation in the second. It is also shown that there are two different mean fluctuation levels of circulation components and climatic data in the two epochs. The changes in circulation and climate regimes connected with a change of epoch are discussed and their effects on long-range weather forecasting are assessed. D.L.G.

N70-16741 Texas Univ., Austin.
A THREE-DIMENSION NUMERICAL STUDY OF THE TEXAS COAST SEA BREEZE
Ronald Duane Mc Pherson (Ph.D. Thesis) 1968 276 p
Avail: Univ. Microfilms: HC $12.60/Microfilm $3.55 Order No. 69-6189

The effect on the Texas coast sea breeze of irregularities in the coast line, specifically the effect of Galveston Bay, is examined by means of a three-dimensional mathematical model which is essentially an extension of an earlier two-dimensional model. The earlier model is examined in detail, is modified on the basis of experimental evaluation, and is extended to three space dimensions. An application to the problem of the effect of Galveston Bay on the sea breeze is undertaken, in which the bay is simulated by a square indentation of an otherwise straight coastline. The results of this application indicate that the presence of Galveston Bay creates a distortion in the sea breeze convergence zone and an asymmetry in the vertical motion field associated with the convergence zone. This asymmetric distribution of vertical motion around the bay is such that the greatest upward motion initially develops northwest of the bay and shifts later to the northeast. Dissert. Abstr.

N70-16798 National Lending Library for Science and Technology, Boston Spa (England).
THE RADIATION BALANCE AND THE MOUNTAIN-VALLEY CIRCULATION IN A MOUNTAIN VALLEY
A. F. Platonova 20 Jul. 1969 27 p refs Transl. into ENGLISH from Tr., Ukr. Nauch.-Issled. Gidrometeorol. Inst. (USSR), no. 29, 1967 p 100–113
(NLL-M-7793-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The dependence of the mountain valley circulation in the Zailiyskiy Alatau region on the radiation balance is considered. Mainly hourly observations of balance and wind made around the clock are used. The observations show that in both the mountain valley and the foothill zone the radiation balance is the basic factor determining the temperature perturbation of the underlying surface and the surface layer of the atmosphere. Circulation currents are determined by the distribution of the balance over the whole mountain slope. The valley breeze is observed only when the balance is positive and its speed is directly related to the balance. There is always gravity flow of air from the hills when precipitation falls in the mountain zone. R.B.

N70-16885 National Lending Library for Science and Technology, Boston Spa (England).
ON THE PROBLEM OF CONTROLLING TEMPERATURE DATA FROM ATMOSPHERIC SOUNDINGS WITH THE AID OF A DIGITAL COMPUTER
N. V. Makurin [1969] 17 p Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), v. 277, 1966 p 68–74
(NLL-M-7708-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A computerized technique for processing radiosonde observational data is described. An algorithm was prepared for radiosonde data control by calculating all its elements from verified initial data. Data fed into the URAL-2 digital computer include standard levels, isobaric surfaces, thicknesses of layers between isobaric surfaces at zero degrees centigrade, station indices, heights of stations above sea level, and the reciprocal of the vertical pressure gradient for surface pressures between 970 and 1040 mb. Heights of isobaric surfaces, dew points on these surfaces, pressures at special points, and temperature and humidity at standard levels were obtained from the controlled calculations. J.M.C.

N70-16890 National Lending Library for Science and Technology, Boston Spa (England).
SOME SPECIAL FEATURES OF THE DISTRIBUTION OF SUMMER PRECIPITATION IN THE ZAILIUSKIJ ALATAU MOUNTAINS
M. H. Bajdal [1969] 12 p Transl. into ENGLISH from Alma-Ata, Kazahskij Nauc.-Issled. Gidromet. Inst., T. Vyp. 29 (Russian), 1967 p 49–54
(NLL-M-7754-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The association between precipitation at different stations in the Zailijskij Alatau and the distribution of precipitation over the mountain range is analyzed. Author

N70-16891 National Lending Library for Science and Technology, Boston Spa (England).
RESULTS OF THE ROUTINE APPLICATION OF METHODS FOR FORECASTING 10-DAY AIR TEMPTERATURES
A. L. Kac et al 25 Sep. 1969 16 p refs Transl. into ENGLISH from Gl. Upr. Gidromet. Sluz., Met. Gidr. (Russian), no. 2, 1968 p 40–45

(NLL-M-7785-(5828.4F)) Avail: Natl. Landing Library, Boston Spa, Engl.: .1 NLL Photocopy coupons

The results of almost two years application of a synoptic-statistical method of forecasting 10-day air temperature anomalies, in the routine practice of the U.S.S.R. Hydrometeorological Centre, are analyzed. The constancy of the relatively high success rate of these forecasts indicates the effectiveness of taking account of distinguishing features of synoptic periods in synoptic – statistical schemes for 5–10 day weather forecasts. Author

N70-16894# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 217 28 Nov. 1969 p 11–25 refs (See N70-16892 05-13)
Avail: CFSTI

Abstracted articles on cloud and atmospheric characteristics, instrumentation, and aerosols are presented. Cloud supersaturation, convective cloud tops, seeding, and cloud processes are studied. Fog characteristics and measurements, and air density and temperature profiles are described. Tropopause parameters and anomalies, and weather forecasting methods are discussed. Data from Arctic drifting station and the relations between water and air temperatures at sea surface are mentioned. A thermoanemometer and ozonometer are mentioned, along with processing data from the Meteor satellite. Aerosol precipitation from flow and aerosol velocities in nonhomogeneous flow are investigated. N.E.N.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-15547# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
THE IFF MARK 10 (SIF) AIR TRAFFIC CONTROL RADAR BEACON SYSTEM PERFORMANCE PREDICTION MODEL
E. F. Freeman (IIT Res. Inst.) Sep. 1969 133 p refs
(Contract F19628-69-C-0073)
(AD-694569; ESD-TR-69-274) Avail: CFSTI CSCL 17/9

The development of the IFF MARK X (SIF) Air Traffic Control Radar Beacon System Performance Prediction Model (ATCRBS PPM) is described. This model provides performance predictions of the entire system or of selected subsystems. Military, civilian, or mixed equipment deployments for any geographic location can be considered. Actual, postulated, or future interrogator and aircraft deployments can be studied to determine system or equipment effectiveness. Deployments can include an unlimited number of aircraft (transponders) operating at altitudes up to 80,000 feet and distributed over an unlimited geographical area. Author (TAB)

N70-15815*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
OPTICAL GUIDANCE SYSTEM (OGS) FOR RENDEZVOUS AND DOCKING Final Report
L. Cardone, D. Coombes, R. Deters, T. Flom, G. Horn et al 31 Jul. 1969 159 p
(Contract NAS8-20717)
(NASA-CR-102387) Avail: CFSTI CSCL 17G

An optical guidance system (OGS) based on techniques and hardware components that are available now was designed for rendezvous and docking on any Apollo Applications Program mission. The general rendezvous and docking problem, and the problem definitions and working assumptions used in this design are presented. The various capabilities of the OGS, and an outline of the baseline with all the subsystems are described, and an analysis of the systems performance (i.e., maximum range, range accuracy, tracking rates, thermal, and laser safety) is also presented. F.O.S.

N70-15891# Technische Univ., Berlin (West Germany). Inst. fuer Flugfuehrung und Luftverkehr.
SELECTION OF NAVIGATION STARS FOR A JUPITER PROBE [AUSWAHL VON NAVIGATIONSSTERNEN FUER EINE JUPITERSONDE]
E. Sollinger Aug. 1969 58 p refs In GERMAN; ENGLISH summary Sponsored by Fluggeratewerk Bodensee Prepared jointly with Ges. fur Verkehrsforsch.
(BMwF-FB-W-69-29) Avail: CFSTI

After a short discussion of the pros and cons of spin stabilization and of three axis-stabilization of a Jupiter space probe, it is assumed that the sum is used for the primary orientation. For the selection of a star as secondary orientation reference, geometrical and physical problems are considered and alpha Car (Canopus) is found to be most suitable. The best trajectories to Jupiter are discussed, and the pointing angles to Canopus as well as the possibility of a false identification are calculated, and an example is outlined. Author (ESRO)

N70-15988# Naval Postgraduate School, Monterey, Calif.
DERIVATION OF THE OPTIMAL CONTROL FOR AN ALL-WEATHER AIRPLANE LANDING SYSTEM
Carl Hugo Dubac (M.S. Thesis) Jun. 1969 105 p refs
(AD-695422) Avail: CFSTI CSCL 17/7

Optimal control theory is used to derive a controller for the final phases of an all-weather landing in the McDonald Douglas F-4J airplane. The landing is formulated as a linear tracking problem by developing a mathematical model for the airplane which is linearized about an equilibrium flight condition, and by defining a desired state trajectory. Examples are presented which illustrate the performance of the system. Author (TAB)

N70-16394# GEC-Elliott Space and Weapon Systems Ltd., Camberley (England). Space and Guided Weapons Div.
THE ELDO INERTIAL GUIDANCE SYSTEM
A. Riley *In* ESRO/ELDO Bull. No. 7 Oct. 1969 p 9–14 refs Sponsored by ELDO (See N70-16392 15-34)
Avail: CFSTI

The inertial guidance system, developed for the launchings from the new equatorial base in French Guiana, which will be installed on the third stage of the ELDO launch vehicle, is described. The overall scheme, and its sub-units, as well as its integration with the autopilots of the stages as well as the prototype systems used for simulation and development tests are outlined. ESRO

N70-16583 California Univ., Los Angeles.
BAYESIAN NONLINEAR FILTER DESIGN FOR SPACECRAFT TERMINAL GUIDANCE
Frederick Aurelius Evans (Ph.D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-3909

Bayesian methods are applied to the design of a non-linear filtering algorithm for digital computers. It is generally recognized that non-linear filters require major approximations for practical realization, and hence the design details are not independent of the application. A sequential digital filtering technique is developed and applied to the important problem of Mars landing terminal guidance. The nonlinear filter design is based on the Bayes Rule computation of the a posteriori conditional probability density from the a priori conditional probability density and data measurement statistics. The a priori conditional probability density is approximated by a continuous function which is the product of a Gaussian density function and a correction factor accounting for non-symmetry of the distribution. The filter estimate is the mode of the computed a posteriori conditional probability density. Hence the filter falls in the class of maximum likelihood estimators. A numerical iterative technique is developed to locate the mode. Dissert. Abstr.

N70-16678*# TRW Systems, Redondo Beach, Calif.
RADIO/OPTICAL/STRAPDOWN INERTIAL GUIDANCE STUDY FOR ADVANCED KICK-STAGE APPLICATIONS. VOLUME 1: SUMMARY Final Report
Washington NASA Dec. 1969 202 p refs
(Contract NAS12-141)
(NASA-CR-1496; TRW-07398-6026-R-00-Vol-1) Avail: CFSTI CSCL 17G

The results of a study of Radio/Optical/Strapdown Inertial Guidance Systems (ROI) for application to future unmanned space missions are reported. This effort extends and refines the work previously carried out and documented under Tasks I and II. This volume presents a summary of results, conclusions, and recommendations for the entire study effort. Author

N70-16719# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands). Oceanographie-Navigatie-Sectie.
THIRD REPORT ON: OMEGA, DIFFERENTIAL OMEGA AND O.P.L.E. FUTURE SEA TRANSPORT, AIR TRANSPORT, AND METEOROLOGICAL PREDICTION NEEDS [DERDE RAPPORT OVER: OMEGA, DIFFERENTIAL OMEGA EN O.P.L.E. TOEKOMSTIGE ZEE-TRANSPORT-, LUCHT-TRANSPORT-ENMETEOROLOGISCHE VOOR-SPELLINGS-BEHOEFTEN]
H. J. Bos Dec. 1968 43 p refs In DUTCH
(TDCK-52032) Avail: CFSTI

Described is the OMEGA very low frequency hyperbolic radio-navigations system that uses the various distances between fixed stations, expressed in phase difference measurements, as measuring units. It encompasses earth, air, sea, and underwater points. The initial accurate 10.2 kHz lane-identification determines the success of the navigation. Addition of a 3.4 kHz signal makes the identification of the 10.2 kHz lane 99 percent accurate. Utilization of larger frequencies is still in the experimental stage. The outgoing frequency spectrum can be used at the same time for other navigation purposes, frequency time standard signals, information distribution, etc. Transl. by G.G.

N70-16787*# United Aircraft Corporate Systems Center, Farmington, Conn.
THE STUDY OF SIMPLIFIED NAVIGATION AND GUIDANCE SCHEMES. VOLUME 1: TECHNICAL ANALYSIS Final Report
G. K. White 31 Oct. 1966 139 p
(Contract NAS12-40)
(NASA-CR-86311; SCR-290-1) Avail: CFSTI CSCL 17G

A study of the navigation and guidance requirements associated with a Jupiter Swing-by Mission has been conducted. The specific mission studied is that of a solar probe injected into a final heliocentric orbit normal to the ecliptic and having a semi-latus rectum of one astronomical unit. This is representative of a Saturn IB/Kick Stage Mission. It is accomplished by a close encounter with Jupiter in which Juppiter's gravitational potential deflects the vehicle into the desired post-encounter heliocentric orbit. To inject a solar probe directly from the Earth into a similar position over the Sun would require almost three times the energy of that of the Jupiter Swing-by Mission. Two navigation schemes were investigated employing on-board, optical-inertial guidance systems. The primary advantage envisioned of the simplified space navigation scheme over that of the linear optimum filter is simplicity of computation with comparable performance. Computer simulations of these navigation schemes were formulated and used to evaluate their relative performance. Author

N70-16788*# United Aircraft Corporate Systems Center, Farmington, Conn.
THE STUDY OF SIMPLIFIED NAVIGATION AND GUIDANCE SCHEMES. VOLUME 2: SIMULATION DOCUMENTATION Final Report
S. M. Vossler 31 Oct. 1966 172 p refs
(Contract NAS12-40)
(NASA-CR-86312; SCR-290-2) Avail: CFSTI CSCL 17G
For abstract see N70-16787.

N70-16822*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
ERROR ANALYSIS OF STRAPDOWN AND LOCAL LEVEL INERTIAL SYSTEMS WHICH COMPUTE IN GEOGRAPHIC COORDINATES
Kenneth R. Britting Nov. 1969 96 p refs
(Grant NGR-22-009-229; DSR Proj. 70343)
(NASA-CR-107741; RE-52) Avail: CFSTI CSCL 17G

A tutorial exposition is given on two broad classes of strapdown and local level inertial navigation systems, which perform their navigational computations in the local geographic coordinate frame. The strapdown chapter includes discussions of the direction cosine update procedure, alignment techniques and instrument redundancy. An analysis of error sources peculiar to the strapdown mechanization is followed by a perturbation type error analysis which shows that the basic error equations are identical to those which describe the behavior of the local level platform system. The error analysis of the local level system is followed by a rather complete set of analytic and computer solutions for both the stationary and moving navigation cases. The effect of the Foucault mode on the validity of the analytic solutions is discussed. The results of the error analysis are applicable to both navigation system mechanizations. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-15628# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
SOME REMARKS ON THE PROBLEM OF EXPLOSIONS IN AN IONOSPHERE WITH FINITE ELECTRIC CONDUCTIVITY IN THE PRESENCE OF A UNIFORM MAGNETIC FIELD
Ferdinand F. Cap 18 Aug. 1969 17 p refs Presented at 2d Intern. Colloq. on Gasdyn. of Explosions, Novosibirsk, USSR, 24–29 Aug. 1969
(Contract F61052-67-C-0014)
(AD-695071; UNICP-SR6715; AFOSR-69-2547TR) Avail: CFSTI CSCL 18/3

The problem of a nuclear explosion in the ionosphere has theoretical and practical relevancy. It is mathematically highly complex and is of importance in connection with the problem of detecting nuclear explosions in space by recording perturbations of the magnetic field of the Earth. Using a MHD characteristics method developed for plasmas with finite electric conductivity the system of the MHD basic equations has been integrated numerically. Furthermore the same system has been reduced to ordinary differential equations using similarity transformations. This formalism gives exact solutions of the MHD basic equations. TAB

N70-15830# Battis Atomic Power Lab., Pittsburgh, Pa.
SOME STUDIES ON THE OXIDATION STATES OF FISSION-PRODUCT IODINE (I-129) IN IRRADIATED URANINITE (LWBR DEVELOPMENT PROGRAM)
J. C. Clayton and J. M. Riddle Jul. 1969 22 p refs
(Contract AT-11-1-GEN-14)
(WAPD-TM-851) Avail: CFSTI

Both the UO2 fuel and Zircaloy cladding from seen irradiated PWR blanket rods were leached, first with methyl chloroform to extract any free iodine, followed by a second extraction with water to collect iodide and iodate ions. Only trace amounts of I-129

activity were detected in the organic leaching solutions,but definite I-129 peaks were identified in the water leachings of the UO2 fuel from one rod. Further leachings with HCl solutions increased the amount of I-129 extracted. It was concluded that, for the quantity of I-129 leached from the irradiated UO2, the major fraction elemental state. The dominant amount of iodine is most likely tightly chemically bound, probably with metallic fission products. This appears reasonable because the oxidation reaction between unirradiated UO2 and I2, as evidenced by X-ray diffraction measurements, would permit the reduction to iodide of any fission-product free iodine produced by fissioning. Author (NSA)

N70-15846# Douglas United Nuclear, Inc., Richland, Wash.
MEASURED ENERGY DEPOSITION RATES FOR VARIOUS NONFISSIONABLE MATERIALS IN A NUCLEAR REACTOR ENVIRONMENT
Paul J. Zimmerman 20 Aug. 1969 16 p refs Presented at the Symp. on Develop. in Irradiation Testing Technol., Sandusky, Ohio
(Contract AT(45-1)-1857)
(DUN-SA-107; CONF-690910-3) Avail: CFSTI

A calorimeter was developed which successfully measured the heat generation rate of many materials in a reactor test facility environment. Measurements were made for materials of sufficiently different properties so that it was possible to separate the heat generation by gamma interactions from thermal neutron interactions. Gamma heating values ranged from 0.16 W/g for Ti to 0.25 W/g for Bi. Heat generation due to nuclear reactions of thermal neutrons was determined by subtracting the gamma heating from the total measured values. The thermal neutron contribution varied from 0 to 9.78 W/g. Thermal neutron contributions exhibited a large dependence on geometry. Thermal neutron absorptions occurring in the vicinity of the material in question increase the gamma flux sigificantly above that contributed by fissioning material in the surrounding lattices. Author (NSA)

N70-15851# Gulf General Atomic, San Diego, Calif.
SCANAL: A SINGLE CHANNEL SYNTHESIS DEPLETION CODE WITH TRIANGULAR MESH IN THE HORIZONTAL PLANE
R. C. Traylor, V. Malakhof, and S. C. Leighton 1 Jul. 1969 143 p refs
(Contract AT(04-3)-633)
(GA-9423) Avail: CFSTI

The digital computer code SCANAL is described. SCANAL is designed to synthesize a three-dimensional power distribution from GAUGE and RELOAD FEVER analyses and to utilize the COPE code to calculate complete distributions of core moderator fuel, and coolant temperatures. The program is written for the UNIVAC 1108. NSA

N70-15858# California Univ., Livermore. Lawrence Radiation Lab.
PRELIMINARY DESIGN CONSIDERATIONS FOR AN ASTRON POWER REACTOR SYSTEM
H. W. Werner, B. Myers, P. B. Mohr, J. D. Lee, and N. C. Christofilos 22 Aug. 1969 38 p refs Presented to the Nucl. Fusion Conf., Abington, Berkshire, 17–19 Sep. 1969 Sponsored by AEC
(UCRL-71768; CONF-690901-4) Avail: CFSTI

The study is concerned with the energy conversion in the blanket and reviews a set of compositions for optimized power or tritium generation. These blankets deliver their sensible heat to a Rankine vapor power cycle. The applicable thermonuclear reaction is: D+T yields He-4+n+17.6 MeV. The deuterium–tritium plasma is contained by the field patter of closed magnetic lines unique to the system. System neutronics, based on variations in composition of Li–Na–Be, include the influence of structural design requirements. The blanket is a niobium structure of modular design operating at a maximum temperature of 1150 K. A modular design of the blanket allows replacement of a relatively low-cost neutron-moderating shell on a schedule matched to time for radiation damage. The blanket is subdivided into two basic units: (1) the throw away neutron moderating shell, and (2) the long life, substantially zero, neutron environment containment vessel, shields, magnet structure, etc. The reactor total output is approximately 12,000 Mw(t). Author (NSA)

N70-15859# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
POWER REACTOR HIGH PERFORMANCE URANINITE PROGRAM ANALYSIS OF FISSION PRODUCT RELEASE RELATED TO CENTERMELT FUEL FAILURES
R. N. Osborne, J. H. Holloway, and C. E. Axtell (Consumers Power Co.) Jun. 1969 17 p refs Sponsored in part by EURATOM
(Contract AT(04-3)-189)
(GEAP-10039; EURAEC-2114) Avail: CFSTI

In June 1968, two developmental UO2 fuel rods failed while operating at high heat rating (27 kW/ft) and with commensurate central melting in the Consumers Big Rock Point Reactor. The data and observations accumulated during surveillance of fission product release are presented. Although the failures did occur at very high heat rating, there was no drastic impairment of the reactor operation. A step increase in the off-gas activity of 4,000 to 5,000 microcurie/sec signaled the onset of failure. Operation continued at the same power level for three more days, with only a very gradual increase in off-gas until a power reduction was instituted or other causes. Transient increases to as high as 23,000 microcurie/sec occurred accompanying power adjustments but at no time did the off-gas approach levels that interfere with routine reactor operation. Author (NSA)

N70-15886# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STAINLESS STEEL CLADDING DEVELOPMENT Quarterly Progress Report, Period Ending 30 Jun. 1969
Aug. 1969 38 p refs
(Contract AT(30-1)-3791)
(WARD-3791-41) Avail: CFSTI

Activities in a program to improve commercially available Type 316 stainless steel for use in LMFBR cladding are reported. Results of mechanical testing are summarized along with those on processing vacuum melted material. Installation of a TIG welding facility or clad weldability testing is reported. Micro-characterization of Type 316 was completed. Sensitization studies continued. NSA

N70-15899# Brookhaven National Lab., Upton, N.Y.
THE DOPPLER COEFFICIENT OF U-238 NEUTRON RESONANCES AND OF THE PWR FUEL CELL
S. N. Purohit Jul. 1969 35 p refs
(BNL-50185) Avail: CFSTI

A study was made of the Doppler coefficient of U-238 neutron resonances, in a uranium dioxide fuel rod, by varying the U-238 resonance parameters (neutron and radiation widths). This study was undertaken with the ZUT and TUZ codes. From the numerical results obtained, it is concluded that the uncertainty in the present values of U-238 resonance parameters (20% in radiation width and a few percent in neutron width) can introduce an uncertainty of the magnitude of 10 to 12% in the Doppler coefficient. In addition, the Doppler coefficient of a power reactor (PWR) fuel cell was studied with the HAMMER code. Extensive numerical results were obtained by varying the fuel enrichment from 0.7 to 3.7%. These results demonstrate that U-238 resonances can contribute up to 10% to the Doppler coefficient, for a 3% enriched fuel cell. Finally, this study confirms the temperature dependence of the resonance integral in the form of the square root of T law. Author (NSA)

N70-15908# California Univ., Livermore. Lawrence Radiation Lab.
POST-IRRADIATION MICROANALYSIS
E. D. Albrecht, J. M. Johnson and W. N. Hayes, Jr. 21 Aug. 1969 6 p refs Presented to the Trans. of the Natl. Symp. on Develop. in Irradiation Testing Technol., Sandusky, Ohio, 9–11 Sep. 1969 Sponsored by AEC
(UCRL-71704; CONF-690910-5) Avail: CFSTI

A technique for examining 0.20 in.-dia by 0.75 in.-long irradiated fuel specimens was developed. Several pieces of specialized apparatus for decladding, subdividing, and analyzing these specimens are described or referenced, and a systematic procedure is given for dimensional measurement and chemical and metallographic analysis of such specimens. Author (NSA)

N70-15916# Minnesota Mining and Mfg. Co., St. Paul, Minn. Electrical Products Group.
SNAP-21 PROGRAM, PHASE 2. DEEP SEA RADIOISOTOPE-FUELED THERMOELECTRIC GENERATOR POWER SUPPLY SYSTEM Quarterly Report, 1 Apr.–30 Jun. 1969
Jun. 1969 186 p refs
(Contract AT(30-1)-3691)
(MMM-3691-52) Avail: CFSTI

Fueled system performace predictions were completed for systems SIOP1, SIOP2, and SIOP3. Dynamic testing and standard reference performance tests were completed on SIOP4. The biological shield which was removed from the insulation system BIODL1 was incorporated into the insulation system BIODL8. The insulation system B10D2 was leak checked and thermally tested. The radiation shield, spider, spider bolt, and inner liner from insulation system B10DL3 were shipped. Thermal performance testing was conducted on insulation units B10DL7 and B10DL8. The insulation system B10DL6 was mated with generator A10P1 for long term testing. Testing continued on Phases 1 and 2 thermoelectric generators and power conditioners. A conceptual design effort was started on the 20 watt system. NSA

N70-15920# Combustion Engineering, Inc., Windsor, Conn. Nuclear Power Dept.
OPTIMUM SPATIAL FLUX CONTROL PROJECT: PHASE 1 CEXE: A THREE DIMENSIONAL NODAL METHOD FOR ANALYSIS OF XENON OSCILLATIONS AND CONTROL
Richard Kern, David C. Wright, W. Carlton Coppersmith, and Zoltan R. Rosztoczy 31 May 1969 132 p refs
(Contract AT(30-1)-3932)
(CEND-3932-1-349) Avail: CFSTI

A simple three dimensional Calculational method that can be used to study xenon oscillations and control in power reactors is described. The CEXE code is based on modified one group theory for the calculation of the neutron source distribution. The mathematical model, application, and logistics of CEXE are presented. Another code, INCEXE, that was written to prepare a portion of the CEXE input, is described. Both codes are written in FORTRAN IV for the IBM 360/65. NSA

N70-15921# Combustion Engineering, Inc., Windsor, Conn. Nuclear Power Dept.
OPTIMUM SPATIAL FLUX CONTROL PROJECT: PHASE 2. XENON OSCILLATION STUDIES FOR THE PICKERING REACTOR
Richard Kern, Mario Bonaca, Zoltan R. Rosztoczy, and W. Carlton Coppersmith 31 May 1969 72 p refs
(Contract AT(30-1)-3932)
(CEND-3932-2-350) Avail: CFSTI

The comparisons of CEXE results with those of diffusion theory, for the one and two dimensional transient problems and the three dimensional equilibrium calculation for the Pickering Reactor, show that good agreement exists between the two methods provided that the nodal source convergence criterion in CEXE is equivalent to the convergence criterion in the diffusion theory calculation. This agreement is independent of the size of the perturbation as well as the length of the time step used in the problem. The one dimensional transient results for the Pickering Reactor indicate that the axial mode is stable and that large perturbations (such as the temporary removal of an adjuster rod bank) and small perturbations (such as refueling one-half of one channel) result in convergent oscillations. The two dimensional transient analysis for Pickering in which the excitation of the azimuthal mode by refueling one fuel channel was investigated demonstrates that this mode is unstable and will lead to rapidly divergent oscillations if no control action is taken. NSA

N70-15972# California Univ., Livermore. Lawrence Radiation Lab.
THE MODULE APPROACH TO BLANKET DESIGN: A VACUUM WALL FREE BLANKET USING HEAT PIPES
R. W. Werner 13 Aug. 1969 38 p refs Presented at the Intern. Conf. on Nucl. Fusion Reactors, Culham, England Sponsored by AFC
(UCRL-71758; Conf-690901-2) Avail: CFSTI

An analysis has been made of the blanket surrounding the thermonuclear plasma which is required to moderate neutrons, provide for kinetic to thermal energy conversion, remove the thermal energy produced, and regenerate the tritium burned in the D–T reaction. The study introduces two new features to blanket design: heat pipes and a modular structure. The study relocates the "standard" vacuum wall of a thermonuclear reactor outboard of the neutron-moderating, energy-converting blanket and thus places the entire moderator in a vacuum envelope and in an unobstructed view of the plasma. The new blanket is structurally designed in modular units which radially and tangentially interlock to form a neutron closed cylinder. The modules consist of sets of thin walled tube banks which have common mass flow and common pressure requirements so that structural design is simple and replacement straightforward. A reference design operating at approximately 1100 K and using natural lithium as a moderator and sodium heat pipes is discussed. Author (NSA)

N70-15974# Oak Ridge National Lab., Tenn.
STRUCTURAL ANALYSIS OF THE BROOKHAVEN NATIONAL LABORATORY PORTABLE CESIUM IRRADIATOR
J. H. Evans Sep. 1969 56 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2293) Avail: CFSTI

An analytical evaluation of the Brookhaven National Laboratory Portable Cesium Irradiator was made to demonstrate its compliance with regulations governing packages in which radioactive material is shipped. Computational procedures and testing and operating experience were used to determine the structural integrity and thermal behavior of the irradiator with respect to the general standards for packaging, the structural standards, standards for normal conditions of transport, and the standards for the hypothetical accident conditions. This analysis demonstrated that with the proposed crash frame, puncture plates, and the other minor modifications, the irradiator complies with all the applicable regulations. Author (NSA)

N70-15975# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
URANIUM-PLUTONIUM CARBIDE DEVELOPMENT Quarterly Progress Report, Period Ending 31 Mar. 1969
May 1969 68 p refs
(Contract AT(30-1)-3791)
(WARD-3791-36) Avail: CFSTI

Activities in a research program are reported on (U,Pu)C directed toward the development of sodium-bonded fuel elements the intents of which are to maximize heat transfer between fuel and cladding and to provide expansion space for fuel swelling to

minimize fuel and mechanical interaction between cladding. The effects of varying binders, milling time, sieve size, purge gas flow rate, and sintering temperature rise rate were studied. Working with the results obtained from the experimental program, modifications were made to the fabrication process, and immediate success was noted. Routine analytical chemistry evaluation of potential EBR-2 fuel and experimental batches continued. Immersion density determinations and metallography were conducted. NSA

N70-15976# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
FAST REACTOR MIXED-CARBIDE FUEL ELEMENT DEVELOPMENT PROGRAM Quarterly Progress Report, Jan.–Mar. 1969
J. Anderson, D. Bristol, L. Flynn, P. Fuery, and C. Grando et al 7 Jul. 1969 44 p
(Contract AT(30-1)-3415)
(UNC-5244; QPR-7) Avail: CFSTI

Activities in programs aimed at development of mixed carbide fuels for LMFBR are summarized. Clad profilometry data from three rods containing high-density helium-bonded mixed carbide pellets irradiated to 40,000 Mwd/t at 28 kW/ft were analyzed indicating that the fuel swells in the range of less than 2.0 to 2.5 % Delta v/v per 10,000 Mwd/t.The capsule trains to test unrestrained swelling and fission gas release of mixed carbides started up in the test reactor. The novel, complex instrumented assemblies are measuring fuel temperatures up to 1600 C. The experiments are operating as designed. The second all-mixed carbide subassembly was inserted and started up in EBR-2 on schedule. The first one has attained over 27,000 Mwd/t burnup. Mixed-oxide pellets made from fully enriched ADU source UO2 and oxalate source PuO2 were sintered with essentially no hourglassing and diametral variations of less than ± 0.0015 in. The plutonium homogeneity was excellent and 100% solid solution was obtained. NSA

N70-15995# General Electric Co., San Jose, Calif. Nuclear Fuels Dept.
POWER REACTOR HIGH PERFORMANCE URANINITE PROGRAM: FABRICATION OF CENTERMELT
D. T. Ikeuye, E. A. Lees, and S. Y. Ogawa Jun. 1969 34 p Sponsored in part by EURATOM
(Contract AT(04-3)-189)
(GEAP-10032; EURAEC-2122) Avail: CFSTI

Fabrication of six fuel assemblies for irradiation testing in the Consumers Big Rock Point reactor is described. Two of the assemblies were referred to as the intermediate performance fuel assemblies and were designed for incipient melting of the UO2 at rated power conditions. There are 64 fuel rods arranged in an 8 x 8 array in each assembly. The fuel rods in one assembly contain UO2 pellets, while the other assembly contains vibratory-compacted UO2. The remaining four assemblies were referred to as the advanced performance fuel assemblies. The fuel rods in these assemblies were designed for moderate melting of the UO2 at rated power conditions. There are 49 rods in an assembly, arranged in a 7 x 7 array. The fuel rods in two assemblies contained sintered UO2 pellets and those in the other two assemblies contained vibratory-compacted powder. Author (NSA)

N70-15996# Gulf General Atomic, San Diego, Calif. Nuclear Fuels Dept.
SPECIFIC ZIRCONIUM ALLOY DESIGN PROGRAM
A. S. Mehner and H. H. Klepfer Apr. 1969 29 p refs Sponsored in part by EURATOM
(Contract AT(04-3)-189)
(GEAP-10026 EURAEC-2118) Avail: CFSTI

A Zr + 2.0 at. % Cr + 0.16 at. % Fe alloy (Zr-Cr) was evaluated as nuclear fuel cladding. Zr-Cr alloy-clad fuel rods were irradiated in the Consumers Big Rock Point reactor to a target exposure of 20,000 MWd/tU. The rate of fuel burnup has been approximately 800 MWd/tU (average) per month of full-power operation. During the June–July 1968 reactor outage, the pool examination of the B-1 assembly indicated that the Zr-Cr and Zircaloy-2 test rods were performing satisfactorily after 8,000 MWd/tU bundle average exposure. Nine test fuel rods and two dummy rods were removed from the bundle and returned to Vallecitos Nuclear Center. The post-irradiation examination of these rods has been initiated. The assembly was reconstituted and the irradiation continued. As of March 31, 1969, the Zr-Cr rods inserted in June 1967 have accumulated an average exposure of 13,936 MWd/tU, and the replacement rods inserted in June 1968 have accumulated an average exposure of 5,936 MWd/tU. Author (NSA)

N70-16037# General Electric Co., San Jose, Calif. Nuclear Fuels Dept.
ZIRCALOY-CLAD UO2 FUEL ROD EVALUATION PROGRAM Quarterly Progress Report, Aug.–Oct. 1968
F. H. Megerth, comp. Nov. 1968 33 p refs
(Contract AT(04-3)-189)
(GEAP-5702; QPR-4) Avail: CFSTI

To demonstrate the capability of Zircaloy-clad fuel to achieve average burnups and to take advantage of the available lead time in achieving these burnup targets, 98 of the higher exposure Fuel Cycle Program rods were incorporated in a special assembly, designated SA-1, and inserted in the Dresden reactor for additional irradiation. Patches of ZrO2 which were considerably more extensive and thicker (83 microns) than normal were noted where rough rings were pronounced. The cause of the rings is unknown. The ZrO2 films on the internal cladding surfaces averaged from less than 1 to a maximum of 5 microns among the two transverse and three longitudinal metallography specimens. The UO2 in three specimens was examined. The grain size in two was uniform; the third showed a small amount of central grain growth. Gas samples collected from two fuel rods were analyzed for carbon dioxide by chromatography. The CO2 content in each case was 0.11 volume percent. Author (NSA)

N70-16095# Atomic Energy of Canada Ltd., Chalk River (Ontario). Fuel Materials Branch.
RECOVERY AND RECRYSTALLIZATION OF URANIUM SILICIDE
P. F. Caillibot (Hydro Quebec) and B. S. Wyatt Oct. 1969 27 p refs
(AECL-3472) Avail: CFSTI; Atomic Energy of Canada, Ltd., Chalk River: $1.00

The recovery and recrystallization temperatures of U3Si were determined for an alloy of uranium-3.98 wt% silicon containing 600 ppm carbon. Small specimens, deformed by compression, were isothermally and isochronally annealed at temperatures between 350 and 700 C and their recovery and recrystallization temperatures determined using hardness, grain size and X-ray measurements. For small amounts of strain and an annealing time of 6 hours both recovery and recrystallization begin at 400–450 C. Complete recrystallization is achieved at 650–700 C. The effect of small changes in silicon and carbon concentration were determined by examining two further alloys containing 3.27 wt% silicon and 600 ppm carbon, and 4.02 wt% silicon and 140 ppm carbon respectively. A small change in silicon concentration does not affect recovery and recrystallization but decreasing the carbon concentration from 600 to 140 ppm decreases the recovery and recrystallization temperatures. Author

N70-16149# Bettis Atomic Power Lab., Pittsburgh, Pa.
SOLID MECHANICS WITH APPLICATIONS TO PRESSURIZED WATER REACTORS
P. L. Pfennigwerth Sep. 1969 113 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-762) Avail: CFSTI

Solid mechanics topics related to pressurized-water reactors are discussed. Topics discussed are deformation of continuous media, stress relationships, material behavior, elasticity, plasticity, creep, matrix analysis of structures, and stability problems. Author (NSA)

N70-16152# Los Alamos Scientific Lab., N.Mex.
CALCULATIONAL MODELING EFFECTS ON FAST BREEDED FUEL CYCLE ANALYSIS
Thomas J. Hirons and R. Douglas O'Dell Apr. 1969 16 p refs
(Contract W-7405-eng-36)
(LA-4187) Avail: CFSTI

The variation of fuel cycle parameters with several burnup-model characteristics is studied. These characteristics are the amount of region detail used in describing the reactor, the initial fissile content of the reactor, the maintenance of criticality during the burnup step, the distribution of the control poison during the burnup step, and the flux or power shift over the reactor lifetime. The mass balances obtained from several of the burnup studies are input to a reactor economics code to determine the economic effects of chages in the model characteristics. The greatest effect on the fuel cycle analysis is produced by the treatment of the relative flux shift between burnup intervals. The assumption of constant flux produces errors in Pu-239 discharge of up to 7% in the axial blankets. When the charge-discharge data are input to the economics code, the assumption of constant flux produces negligible differences in power costs, but results in an error of about 5% in the net yield of fissile isotopes per MW(w)-yr. Author (NSA)

N70-16164# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Div. Affair Internazionali e Studi Economici.
AEROSPACE NUCLEAR SAFETY: A BIBLIOGRAPHY OF SELECTED LITERATURE, 1960-1968
Radames Venchiarutti 1969 332 p refs
Avail: CFSTI

This bibliographical study contains almost 3000 references covering general nuclear aerospace safety problems with special attention given to radio-isotopic systems. The references are arranged under eighteen broad subject headings. ESRO

N70-16170# Technische Hogeschool, Eindhoven (Netherlands).
THE MEASUREMENT AND CALCULATION OF THE REACTIVITY WORTH OF SAMPLES IN A FAST HETEROGENEOUS ZERO POWER REACTOR
Willem Jan Oosterkamp (Ph.D. Thesis) 1969 51 p refs
Avail: CFSTI

A method is developed to account for sample size and environmental effects of reactivity worth experiments in heterogeneous zero power reactors. The method bases on a perturbation expression of integral transport theory in the multigroup collision probability formulation. The method accounts for space dependent resonance self-shielding. A pile oscillator element is described that only slightly perturbs the slab geometry of the reactor. The experiments can therefore be interpreted with a one dimensional model. The inverse kinetics method is extended to account for periodically moving fuel. Theory and experimental equipment were tested in a series of measurements in SNEAK. The theory and the results of the perturbation expression of diffusion theory are compared for these experiments. Author

N70-16184# Pennsylvania State Univ., University Park. Dept. of Nuclear Engineering.
NEW PROTECTIVE SYSTEM DESIGN TECHNIQUES FOR APPLICATION IN NUCLEAR REACTOR PLANTS, PHASE 1, VOLUME 2
M. A. Schultz and G. C. Geisler 31 Mar. 1969 430 p refs
(Contract AT(30-1)-3986)
(NYO-3986-1-Vol-2) Avail: CFSTI

Abstracts of references on techniques to assure the reliability of components and systems in reactor protective systems are presented. For Vol. 1, see N70-13421. NSA

N70-16190# Idaho Nuclear Corp., Idaho Falls.
PERFORMANCE OF TITANIUM AND NIOBIUM ELECTRODES IN AN ELECTROLYTIC DISSOLVER FOR NUCLEAR FUELS
R. G. Butzman and N. J. Kartamus Aug. 1969 15 p refs
(Contract AT(10-1)-1230)
(IN-1191) Avail: CFSTI

Corrosion measurements revealed that titanium could be used, with low corrosion rate, as the cathode-container for an electrolytic dissolver for nuclear fuels operated with 6*M* or greater nitric acid. The corrosion rate for titanium decreased with increasing nitrate ion concentration at constant current density and increased with increasing current density. The anodic current-potential characteristics of the valve metals niobium and tantalum were studied in nitric acid. Both the current flow and the corrosion rate, even at 50 volts and 55 C, were low enough to permit the use of either metal as a support for the active platinum anode in the dissolver. Author (NSA)

N70-16220# Advisory Group for Aerospace Research and Development, Paris (France).
NUCLEAR SPACE POWER SYSTEMS
H. M. Dieckamp *In its* Space Power Systems, Pt. 1 Nov. 1969 p 91-302 refs (See N70-16217 05-03)
Avail: CFSTI

A general discussion is given of previous nuclear power systems used in space. The nuclear system offers definite advantages of ruggedness, high power per unit area, no collector deployment, continuous power, minimum power storage requirements, and no orientation, factors which limit the use of batteries and other chemical systems. As the power requirements are increased to the order of tens of kilowatts, the nuclear reactor systems have an increasingly favorable weight, size, and cost advantage over any of the presently envisioned solar power systems. The Systems for Nuclear Auxiliary Power program is discussed within the context of increased power requirements to fill future needs. R.B.

N70-16239*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMPLIFIED ANALYSIS OF NUCLEAR FUEL PIN SWELLING
Armin F. Lietzke Washington Jan. 1970 43 p refs
(NASA-TN-D-5609; E-5145) Avail: CFSTI CSCL 18J

The effect of fuel swelling on strains in the cladding of cylindrical fuel pins is analyzed. Simplifying assumptions are made to permit solutions for strain rates in terms of dimensionless parameters. The results of the analysis are presented in the form of equations and graphs which illustrate the volumetric swelling of the fuel and the strain rate of the fuel pin clad. Author

N70-16362# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
EVALUATION OF THE POTENTIAL OF SELECTED ALLOYS FOR USE AS A FUEL CLADDING MATERIAL IN AN LMFBR
C. G. Collins, J. Moteff, and B. A. Chandler Jun. 1969 312 p refs
(Contract AT(40-1)-2847)
(GEMP-573-Rev) Avail: CFSTI

The evaluation is based on reviews of the data on the sodium corrosion resistance, nuclear characteristics, irradiation effects, and creep or creep-rupture properties. The materials considered include the alloys of iron, nickel, cobalt, vanadium, niobium, molybdenum, tantalum, and tungsten. It is concluded that the alloys of immediate potential are the austenitic steels and the Fe-Cr-Co-Ni alloys and that those with development potential offering higher creep strengths include the nickel alloys with less than approximately 50 percent nickel, and the cobalt, vanadium, molybdenum, and

niobium alloys. The ferritic steels, nickel alloys with greater than approximately 50 percent nickel, and the tantalum and tungsten alloys are classified as of limited interest. Irradiation effects are considered the most important problem area for all of the alloy classes. Other limitations noted include the strength of the austenitic steels, the ductility of the cobalt alloys, corrosion of the nickel, vanadium, and niobium alloys, and the nuclear characteristics of niobium and molybdenum alloys. Author (NSA)

N70-16483# Atomics International, Canoga Park, Calif.
OPERATION OF THE SYSTEMS QUALITY SODIUM LOOP Interim Report
E. W. Murbach and N. W. Heath 20 Aug. 1969 17 p refs
(Contract AT(04-3)-701)
(AI-AEC-12801) Avail: CFSTI

The Systems Quality Sodium Loop has been operated more than 20,000 hr. Over 100 retorts, small supply tanks, and other devices have been loaded with sodium from the loop. The carbon content has been maintained at less than 10 ppM; the oxygen content was also maintained at less than 10 ppM, probably less than 5 ppM. The hot-trap developed a leak and has been removed. There are no carbon sources in the loop, so the carbon content of the sodium has not increased. It is planned to replace the hot-trap. Three electrochemical oxygen-meter electrodes have been operated in the loop. All three electrodes have been responsive to changes in oxygen level. Author (NSA)

N70-16516# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).
CONTROL SYSTEM PHILOSOPHY FROM THE NUCLEAR REACTOR FIELD
A. Pearson *In* Brookhaven Natl. Lab., Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 123–133 refs
(See N70-16501 05-24)
Avail: CFSTI

Various redundancy techniques which apply only to control systems are discussed. The introduction of digital computer philosophy for reactor control is also presented. NSA

N70-16678*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY ANALYSIS OF ACCIDENTS IN A LITHIUM-COOLED SPACE NUCLEAR POWERPLANT
Harry W. Davidson Washington Jan. 1970 25 p refs
(NASA-TM-X-1937; E-5123) Avail: CFSTI CSCL 18I

Reactor power, fuel, and coolant temperature responses to five types of accidents (loss of coolant, loss of flow, ramp reactivity insertions, cold lithium additions, and plugging of coolant channel) occurring at 100 percent power were calculated to establish preliminary safety requirements for a uranium nitride-fueled fast reactor. Loss of coolant must be avoided, or auxiliary coolant must be provided within 380 sec to avoid melting the fuel. After losing coolant flow, natural convective cooling is inadequate, and auxiliary pumps may have to provide up to 20 percent of the design flow to prevent coolant boiling. Author

N70-16744# Oak Ridge National Lab., Tenn.
INHERENT NEUTRON SOURCE IN MSRE WITH CLEAN U-233 FUEL
R. C. Steffy, Jr. 10 Aug. 1969 22 p refs
(ORNL-TM-2685) Avail: CFSTI

After about three years of nuclear operation, the MSRE fuel, enriched U-235, was replaced with a U-233 fuel mixture. In this new mixture there are quantities of U-232, U-233, and U-234. Each of these, along with the U-232 decay chain, is a strong alpha emitter and interacts with F, Be, and Li to produce neutrons. This neutron source is time-dependent because of the buildup of U-232 daughters, and at the time of reaching criticality with the U-233 fuel, the neutron source in the MSRE core was about 4×10 to the 8th power neutron/sec, primarily from the reactions Be-9(alpha,n)C-12 and F-19(alpha,n)Ne-22. Alpha-n reactions with Li will produce $< 3 \times 10$ to the 6th power neutrons/sec. Spontaneous fission will produce < 10 to the 2nd power neutrons/sec. 11 references. Author (NSA)

N70-16791# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
VANADIUM ALLOY CLADDING DEVELOPMENT Quarterly Progress Report, Period Ending 31 Mar. 1969
E. C. Bishop, R. A. Nadler, and G. A. Whitlow May 1969 49 p refs
(Contract AT(30-1)-3791)
(WARD-3791-34) Avail: CFSTI

During the report period the nuclear and economic analysis of vanadium fuel element cladding was completed. All of the requested rod in the five alloys has been shipped to AEC contractors; most of the requested sheet has also been shipped. Tube drawing is proceeding; difficulties have been experienced with the drawing of the V–15Cr–5Ti alloy. Rupture life and secondary creep rate in the VANSTAR-7 alloy are markedly affected by purity of the test environment. Samples removed from the high velocity corrosion loop (14 fps) after 1500 hours operation all showed weight gains, which were, as anticipated, greater than the weight gains observed in the low velocity system (5 fps). High surface concentrations of interstitials have been confirmed in the 1500 hour corrosion samples. Little further deterioration in mechanical properties was observed in corrosion samples exposed to sodium for 2650 hours. Author (NSA)

N70-16800# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FAST FLUX TEST FACILITY Quarterly Technical Report, Mar.–May 1969
E. R. Astley Jul. 1969 198 p refs
(Contract AT(45-1)-1830)
(BNWL-1090) Avail: CFSTI

Design and development during March to May 1969 is summarized for the Fast Flux Test Facility and for the Fast Test Reactor (FTR). Progress is reported on conceptual design of a containment system, shielding analysis, a management scheme for maximum fuel burnup, coolant pressure drop for fuel assemblies, hot channel factors in cores, radioisotope transport and deposition in liquid sodium coolant, development and fabrication of structural materials, fuels, and fuel element cladding, radiation testing of FTR driver pins, and accident analyses for reactor safety at the facility. NSA

N70-16803# Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuigbouwkunde.
TEMPERATURE MEASUREMENT BY THERMOCOUPLES. EXPERIMENT AND SIGNAL RECORDINGS IN THE TEMPERATURE REGION 0 TO 2500 C [TEMPERATUURMETING MET THERMOKOPPELS. GEDRAGEN SIGNAALVERWERKING IN HET TEMPERATUURGEBIED 0–2500 C]
T. Goemans Jun. 1969 47 p refs In DUTCH
(THD-KR-190; WTHD-13) Avail: CFSTI

A survey is given on application and performance difficulties of thermocouples. Special emphasis is placed on insulated thermocouples. After a review of the various thermocouple materials and sensors for extreme high temperatures the drift and stability of chrome-aluminum is discussed. Thermal stability as well as radiation resistance are evaluated. After a description of surface measurements, a number of typical applications in reactor technology are given. The possibilities of automatic signal processing are mentioned and its application in the Neptunus project is described. Transl. by G.G.

N70-16811 Iowa State Univ. of Science and Technology, Ames.
ANALYSIS OF COUPLED CORE REACTORS USING THE NATURAL MODE APPROXIMATION
Joaquin Manuel Betancourt (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-4213

A space dependent reactor kinetics approximation, called the natural mode approximation, is used to solve the space-time kinetic equations for coupled-core nuclear reactors. In this formulation the space and time dependent neutron fluxes and other dependent variables of the reactor system are approximated by a series of products of unknown time dependent coefficients and known spatially dependent expansion vectors. These expansion vectors are called the natural modes of the system and are the eigenvectors of the linear steady state operator which describes the system at an initial reference condition. The present analysis includes time domain and frequency domain investigations. Numerical calculations are carried out for a one-dimensional three-region unreflected coupled-core reactor and for a one-dimensional model of a coupled-core Argonaut type reactor. Results of the analysis of space dependent effects due to oscillation tests are compared with independent results in which the Green's function modes are the basis functions. Dissert. Abstr.

N70-16834# Argonne National Lab., Ill.
REACTOR PHYSICS DIVISION Annual Report, 1 Jul. 1967–30 Jun. 1968
30 Jun. 1968 445 p refs
(Contract W-31-109-eng-38)
(ANL-7410) Avail: CFSTI

Sections of the report, for which separate abstracts are prepared, include: Fission Properties and Cross Section Data; Thermal Reactor Physics; Fast Reactor Physics; Fast Reactor Safety; Experimental Techniques and Facilities; and Reactor Computaton Methods and Theory. NSA

N70-16844# California Univ., Livermore. Lawrence Radiation Lab.
LIQUID-METAL CORROSION EXPERIMENTS: THE PUMPED CAPSULE
Rudolf B. Rozsa 2 Dec. 1968 29 p refs
(Contract W-7405-eng-48)
(UCRL-50511; M-3679; C-44B) Avail: CFSTI

The pumped capsule was designed to study the dynamic corrosion of materials used to contain liquid-metal coolants in space-power nuclear reactors. The pumped capsule consisted of a closed tube containing a splitter plate which separated the tube into two channels. The channels join at the ends of the tube to form a closed loop. The liquid metal was circulated in the capsule by an electromagnetic conduction pump. Radiant heating of one end of the capsule and radiation cooling of the other simulated the operation of a liquid-metal coolant loop. In the experiments, liquid lithium was circulated in W–Re–Mo alloys at temperatures to 1650 C for times as long as 1000 hr. Little corrosion damage was observed. Author (NSA)

N70-16859# Atomics International, Canoga Park, Calif.
HIGH HEAT FLUX HEATER DEVELOPMENT Status Report
E. L. Babbe, J. H. Shively, and M. W. Mahoney 15 Jul. 1969 35 p refs
(Contract AT(04-3)-701)
(AI-AEC-12813; Rept-2) Avail: CFSTI CSCL 18/10

Electrical heaters that produce surface heat fluxes are being successfully used for fuel cladding tests in sodium. A continuing program, to increase heater life while collecting cladding test data, has yielded design changes which have been tested and analyzed. The major factors affecting heater life are the compatibility of heater component materials, and design accommodation of dimensional changes during service. Two important modifications to the heater were: a rhenium disc for the upper diffusion barrier, and a hollow graphite heating element with solid end plugs. Both modifications proved to be successful in extending heater life. The heater reference design now includes a rhenium wafter as an upper diffusion barrier, with a solid graphite heating element. A backup design utilizes a hollow graphite heating element with solid end plugs and, as yet, an undetermined upper diffusion barrier. Author (NSA)

N70-16863# Gulf General Atomic, San Diego, Calif.
GAS-COOLED FAST BREEDER REACTOR Quarterly Progress Report, 1 May–31 Jul. 1969
30 Aug. 1969 121 p refs
(Contract AT(04-3)-167)
(GA-9639) Avail: CFSTI

Progress in core design, fuel elements, and materials development for gas cooled fast breeder reactors is evaluated. Test and potential irradiation facilities are evaluated along with the experimental fuel rod behavior model. Work done on the liquid metal fast breeder reactor fuel model is reviewed. Annealing of radiation induced swelling in fast reactor structural materials, creep behavior of fuel oxides, and the in-pile and out-of-pile test program are also evaluated. An experimental program for the use of plutonium fuel is mentioned. J.M.C.

N70-16869 Iowa State Univ. of Science and Technology, Ames.
HAMILTONIAN FORMALISM APPLIED TO MULTIDIMENSIONAL REACTOR SYSTEMS AND RELATED CONCEPTS
Larry Charles Madsen (Ph.D. Thesis) 1968 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-4260

The extension of the Hamiltonian formalism to reactor theory in a general manner is presented. From the Lagrangian of a general continuous system, the Hamiltonian was derived, and the concept of the canonical transformation discussed. The generalized form of the Hamilton Jacobi equation is developed and the mathematical and geometrical implications of the equation are discussed. Related concepts from classical mechanics such as Poisson brackets and the conservation laws relating to the stress tensor and Noether's theorem are considered. The canonical transformation is shown to be a fundamental concept in the description of the evolution of a dynamical system. The Hamiltonian density was derived for several equations that are used in reactor theory. Dissert. Abst.

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-15532# Vitro Labs., Silver Spring, Md.
ACOUSTIC MICROBUBBLE SPECTRUM ANALYZER
William R. Turner 30 Sep. 1969 60 p refs
(Contract N00014-66-C-0152)
(AD-695068; TN-01992.01-1) Avail: CFSTI CSCL 20/1

The instrument is intended to analyze in situ microbubble populations by detecting differential ultrasonic velocity and attenuation between a seawater sample and a reference liquid over continuous frequency range from 0.1 to 5.0 MHz. Wave guides are used to confine the ultrasonic paths. The first pass wave guide signals are separated from multiple reflections by using a ramp frequency signal heterodyning the wave guide output signals against the ramp, and selecting the lowest difference frequency. The differential velocity is obtained digitally by timing the periods of processed wave guide signals, and the differential attenuation by

logarithmically comparing amplitudes. Generation of a sufficiently linear and noise-free ramp signal and design of identical wide band ultrasonic transducers were particular problems addressed during the contract period. Author (TAB)

N70-15555# Rand Corp., Santa Monica, Calif.
IRRADIANCE STATISTICS, MODULATION TRANSFER FUNCTION AND PHASE STRUCTURE FUNCTION OF AN OPTICAL WAVE IN A TURBULENT MEDIUM
H. T. Yura and R. F. Lutomirski Sep. 1969 27 p refs
(Contract DAHC15-67-C-0141)
(AD-695412; RM-5905-ARPA) Avail: CFSTI CSCL 20/6

An analysis of experimentally observed far-field irradiance statistics, suggesting an approach to calculating the probability distribution for intensity fluctuations of an optical wave in a turbulent medium and expressions for measuring important wave characteristics. Two theoretical treatments of probability distribution are investigated. Because none of the proposed theories can account for irradiance statistics in a consistent manner, it is suggested that a modified geometric optics approach would lead to an improved quantitative understanding of the phenomena. Expressions are derived for measuring wave phase structure function and modulation transfer function. Results are useful in determining the limited resolution obtainable in forming an image through a turbulent medium, as well as in calculating the signal-to-noise ratio of an optical heterodyne detection system. Author (TAB)

N70-15694# Air Force Systems Command, Wright-Patterson AFB, Ohio.
PROPERTIES OF THE INFRARED DISPERSION FUNCTIONS OF ISOLATED RESONANCES Technical Report, Sep.–Dec. 1968
Conrad M. Phillippi Aug. 1969 97 p refs
(AD-694518; AFML-TR-69-31) Avail: CFSTI CSCL 20/12

This is a computational study of the relationships between infrared reflection band properties and oscillator parameters as given by classical dispersion theory. It is limited to the case of frequency-independent damping, normal incidence, isolated resonances. A total of 81 parameter combinations are computed, of which the reflection bands of 42 are illustrated and the essential band properties of all are tabulated. The effects of the various parameters on band properties are discussed in detail and from this a prediction capability is developed. A method is devised for the converse operation of recovering oscillator parameters from band properties by graphical functions. Three examples are worked to demonstrate the method from which approximate values of the parameters accurate from 5 to 20% are obtained. These results provide the basis for an efficient approach to infrared dispersion analysis by computational curve fitting. Author (TAB)

N70-15697 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF THE VELOCITY OF SOUND AND THE DECREMENT OF ATTENUATION OF SOUND-WAVES IN TWO-PHASE MEDIA
M. E. Deich 24 Sep. 1969 22 p refs Transl. into ENGLISH from Prace Inst. Maszyn Przeplywowych. Polska Akad. Nauk (Warsaw), no. 29–31, 1966 p 141–159
(NLL-CE-Trans-5014-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL Photocopy coupons

The derivations and discussions of the wave equations for a two-phase medium are presented, which serve to determine the behaviour of the sound-wave in wet steam under different parameters of state. A method of analysis was adopted which rendered it possible to examine the entire complex of internal flow processes with regard to the acoustic properties of the two-phase medium, in contrast to earlier attempts to examine the problem on the basis of pure thermodynamics or gas-dynamics. A system of equations is derived which are valid for the entire two-phase zone of the parameters of state for the medium. This system is presented in a non-dimensional linearized form. The criteria of similarity for this type of medium, in contrast to a homogeneous medium, are also discussed. Author

N70-15735# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
GLOSSARY OF OPTICAL PROPERTIES
Richard I. Akawie, Sheldon J. Welles, and Imee J. D'Haenens Feb. 1969 92 p
(Contract F33615-68-C-1225)
(AD-695479; S-10) Avail: CFSTI CSCL 5/2

A glossary of optical property indexing terms used by the Electronic Property Information Center is presented. Twenty eight primary optical property descriptors and over 180 related terms are carefully defined. A detailed list of property cross references provides a complete index to the glossary. Author (TAB)

N70-16083# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France). SEV/OP Dept.
BIBLIOGRAPHIC STUDY ON FIBER OPTICS [ETUDE BIBLIOGRAPHIQUE SUR LES FIBRES OPTIQUES]
M. Abraham 23 Sep. 1969 111 p refs In FRENCH
(LRBA-NT-7-69-SEV-OP) Avail: CFSTI

The propagation of electromagnetic radiation in optical fibers is analyzed and some applications are discussed. These include image transmission, medical uses, and highspeed and infrared photography. ESRO

N70-16205# Computer Applications, Inc., New York. Systems Engineering Div.
SYSTEMS ANALYSIS AND REVIEW OF BEAM PATTERN, DIRECTIVE INDEX, AND ARRAY GAIN CALCULATIONS Final Report
20 Aug. 1969 115 p refs
(Contract N00140-68-D-0394)
(CAI-SED-1010-03) Avail: CFSTI CSCL 17/1

The purpose of the task was to perform a systems analysis study of the U. S. Naval Underwater Sound Laboratory's computer program capability for the calculation of sonar array beam patterns, directivity indices, and array gain. TAB

N70-16349# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DETECTION OF VERY WEAK LUMINOUS FLUXES: APPLICATION TO THE OPTIMAL DETECTION OF LASER ECHOES AND TO THE CHARACTERIZATION OF OPTICAL COHERENCE [DETECTION DES FLUX LUMINEUX TRES FAIBLES: APPLICATION A LA DETECTION OPTIMALE DES ECHOS LASER ET A LA CARACTERISATION DE LA COHERENCE OPTIQUE]
Jean Boillot (Ph.D. Thesis — Paris Univ.) 1969 69 p refs In FRENCH; ENGLISH summary
(ONERA-NT-150) Avail: CFSTI

The photoelectric detection of luminous fluxes of very low intensity leads to counting individual photoelectrons and to studying their temporal repartition. Research carried out in this domain has been applied to an optimization problem of laser echo detection within a parasite luminous background. According to the noise and signal levels, it is possible to choose the appropriate detection system and to determine its necessary adjustments. The experimental device has been modified in view of making an experiment on the statistical characterization of light coherence. Author (ESRO)

N70-16370# Parke Mathematical Labs., Inc., Carlisle, Mass.
A METHOD FOR THE PREDICTION OF THE FARFIELD FROM NEARFIELD AMPLITUDE MEASUREMENTS OF A COHERENT SOUND FIELD
John L. Butler Oct. 1969 15 p refs
(Contract N00014-67-C-0424)

(AD-694079; SR-5) Avail: CFSTI CSCL 20/1

A method is presented for the prediction of the farfield from nearfield measurements of the amplitude alone of a coherent field. The method is based on a finite series wavefunction expansion for the pressure amplitude in the field. It is shown that with the expansion specialized for a coherent field there is a vast improvement over a previous general method for partially coherent fields. Author (TAB)

N70-16418 Columbia Univ., New York.
A STUDY OF PERSISTENT CURRENTS IN SUPERCONDUCTING NIOBIUM WITH 25 PERCENT ZIRCONIUM
Joseph File (Ph.D. Thesis) 1968 246 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 69-3062

The decay of the magnetic field produced by a persistent current flowing in a superconducting solenoid wound with Nb-25%Zr wire has been measured at various values of the self-induced magnetic field. The field was varied through the approximate range of 7 to 832 gauss below the critical field. The results of these experimental runs indicate that over the range of values of the field, the logarithm of the decay rate varies linearly with the field. An estimate of the size of a flux bundle can be made from the result and is 0.000005 cm. Dissert. Abstr.

N70-16419# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
AEOLIAN TONES ASSOCIATED WITH RESONANT VIBRATION
Patrick Leehey and Carl E. Hanson Jun. 1969 52 p refs
(Contract Nonr-3963(26))
(AD-695066; A/V-76234-4) Avail: CFSTI CSCL 20/1

Measurements of oscillating lift coefficient, spanwise correlation length, Strouhal number, and radiated sound intensity were made on the same cylinder under the same test conditions over a Reynolds number range of 4000 to 6450. These measurements verified that the Curle theory of dipole radiation as expressed by Phillips for the Aeolian tone holds for a cylinder resonantly excited by a periodic wake in air. For small amplitude vibration, the increase of oscillating lift coefficient with Reynolds number accounts for the increase of sound intensity. Author (TAB)

N70-16671 Michigan State Univ., East Lansing.
LOW TEMPERATURE ADIABATIC STUDIES OF MAGNETIC PHASE BOUNDARIES IN ANTIFERROMAGNETS
James Nathaniel Mc Elearney (Ph.D. Thesis) 1968 188 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-5912

A theoretical treatment of antiferromagnetism, for arbitrary spin values, is given, based on previous extensions of the molecular field model of antiferromagnetism. Theoretical predictions involving the magnetic phase boundaries are given. A new method to predict critical fields for spin flopping, using three magnetic susceptibility measurements, is proposed and the theoretical basis for adiabatic investigations of antiferromagnetic spin flop states is given. Apparatus and methods for such experiments are described. Dissert. Abstr.

N70-16672 Texas Christian Univ., Fort Worth.
ELECTROMAGNETIC TRANSMISSION PROPERTIES OF A MODEL IONOSPHERE IN THE FREQUENCY RANGE .001 - .1 Hz
Anthony John Bielecki (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-6596

An attempt is made to determine the effect of the ionosphere upon the character of the power spectra of measured terrestrial magnetic field variations in the micropulsation region of the electromagnetic spectrum. A theoretical model of the earth's ionosphere is developed for situations approximating the physical conditions at mid-geomagnetic latitudes. The model is constructed so that it is possible to compute the electromagnetic transmission properties in the frequency range .001 to 0.1 Hertz. The earth is assumed to be an infinite half-plane with the electrical properties of a perfect conductor. The structure of the ionosphere is taken to be plane layered with the planes parallel to the surface of the earth. It is concluded that the ionosphere below 2000 km does not significantly contribute to the character of observed terrestrial geomagnetic power spectra. Dissert. Abstr.

N70-16748 California Univ., Los Angeles.
ELECTROMAGNETIC SCATTERING BY A DIELECTRIC COATED PERFECTLY CONDUCTING CIRCULAR CYLINDER WITH AZIMUTHAL DISCONTINUITIES IN THE DIELECTRIC CONSTANT
Claude Vincent Baker (Ph.D. Thesis) 1968 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-5296

The electromagnetic scattering by an infinitely long, perfectly conducting cylinder containing a thin dielectric coating is considered. The dielectric constant of the coating is discontinuous in the azimuthal direction. The problem is solved through an extension of the Wiener Hopf technique into infinite angular space. The scattering is computed by extending the geometrical theory of diffraction. Asymptotic evaluations of the expressions obtained are given. Numerical calculations for the backscattering by moderately sized cylinders is presented. Dissert. Abstr.

N70-16796 Duke Univ., Durham, N.C.
GENERATION PROPAGATION AND ATTENUATION OF PRESSURE WAVES IN SOLID-LIQUID SUSPENSIONS
David Teh-yu Kao (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-7681

Analytical and experimental analysis of the generation and propagation of pressure waves in confined solid-liquid suspended flow and the pressure wave attentuation due to two-phase effects are discussed. Basic principles of conservation of mass and momentum together with the characteristics of waves were used to carry out the analytical analysis of the two-phase unsteady flow. Both initial and boundary conditions were considered and satisfied in the analytical calculations. Experimental measurements were carefully analyzed and compared with the analytically predicted values. A high speed movie technique was utilized for the visual study of the transient flow system. Results are presented and compared with the analytical ones. Wave front attenuation was studied in detail. Experiments were first conducted studying the pressure wave attentuation in single-phase liquid flow. Dissert. Abstr.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-15507# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
DIFFICULTY AND POSSIBILITY OF KINETIC THEORY OF QUANTUM-MECHANICAL SYSTEMS
Toyoki Koga May 1969 55 p refs
(Contract Nonr-839(38); ARPA Order-529)
(AD-695410; PIBAL-69-17) Avail: CFSTI CSCL 20/10

In kinetic theory which intends to treat the evolution, in time and in configuration space, of a system not in thermal equilibrium, it is necessary to consider correlative behaviors of

constituent particles or correlations among elementary behaviors of the system. Correlative behaviors are conceivable only when each elementary behavior is distinguishable from the others. In the quantum-mechanical formalism, first, the uncertainty principle prohibits a particle to follow a completely prescribable path; second, due to the symmetry (bosons) or antisymmetry (fermions) principle, each particle exists at many states, as many as similar particles in a system, at the same time. Therefore, it is impossible to consider kinetic theory as in accordance with the quantum-mechanical formalism. Nevertheless, evidences of kinetic-theoretical processes occurring in quantum-mechanical systems are pointed out. Also evidences of limited range (in time and in configuration space) of validity of the symmetry or antisymmetry principle are indicated.
Author (TAB)

N70-18514# Stanford Univ., Calif.
DETERMINATION OF THE REAL PART OF THE COMPTON AMPLITUDE AT A NUCLEON RESONANCE
Stanley J. Brodsky, Anthony C. Hearn, and Ronald C. Parsons Jul. 1969 25 p refs Submitted for publication Sponsored in part by AEC and NSF Prepared in cooperation with Texas Univ.
(Contract F44620-68-C-0075; ARPA Order SD-183)
(AD-694033; SLAC-PUB-634; ITP-336; CPT-10) Avail: CFSTI CSCL 20/8

The real part of the virtual Compton amplitude can be directly determined from measurements of electron (or muon) bremsstrahlung or pair photoproduction. In general, the interference of the Compton amplitude with the Bethe-Heitler amplitude for pair production or bremsstrahlung yields a contribution to the cross section which is antisymmetric when the leptons are interchanged. This interference contribution thus produces different cross sections for electron and positron bremsstrahlung at a given scattering energy and angle. Also, the counting rate for pair production will depend on which lepton has the greater momentum. The determination of the real part of the Compton amplitude would supply information on the isobar resonance shape, test the dispersion relation for the forward amplitude, and resolve uncertainties in the determination of the nucleon resonances. A simple estimate for the lepton asymmetry of the pair production cross sections due to the forward Compton amplitude is given in addition to a complete calculation of the effect of the first nucleon resonance using the isobar model. The results are also discussed for nuclear targets. For the latter case, a broadening of the isobar decay width due to absorption in the nuclear medium must be taken into account.
Author (TAB)

N70-18519# Technische Hochschule Munchen (West Germany).
MOESSBAUER EFFECT OF NEODYMIUM 145 [MOESSBAUER-EFFEKT AN NEODYM-145]
Guenter Kaindl (Ph.D. Thesis) 2 Jul. 1969 66 p refs In GERMAN
Avail: CFSTI

Measured is the isomeric shift in the 72.50 keV gamma-line between source and neodymium absorber, as well as on 2- and 3-valence neodymium compounds. Hyperfine splitting of the gamma-line in magnetically ordered intermetallic compounds and paramagnetic salts are measured in external magnetic fields of 30 kOe. Analysis of observed hyperfine spectra determined the spin I = 5/2 in Nd0.01Y0.99Cl×6H2O at 72.50 keV. Results for uneven N = 85 nuclei are discussed and systematic analogies for the lowest excitation levels are depicted. Magnetic hyperfine fields, determined from measurements on the neodymium nucleus center in magnetic ordering neodymium compounds, are markedly lower than the free ion value for the 4I9/2-ground level of the Nd ion; this effect is attributed to a strong cubic crystal lattice.
Transl. by G.G.

N70-18520# Technische Hochschule Munchen (West Germany).
DEFORMED NUCLEI IN ISOTOPIC LEVELS OF RUBIDIUM 105 TO RUBIDIUM 110 [DEFORMIERTE KERNE IM BEREICH DER ISOTOPE RU 105 BIS RU 110]
Gerhard Zicha (Ph.D. Thesis) 1969 78 p refs In GERMAN
Avail: CFSTI

Radiochemical methods were used to separate fission products and their daughters 4 seconds after neutron irradiation of uranium-235. Gamma spectra and gamma–gamma coincidence measurements on isotopic decay and life times identified the line potential of rubidium-106 as the ground level-rotation band of a strongly deformed nucleus; evaluation of the 2 + excitation level gave the deformation parameter 0.55 plus or minus 0.03. Line potentials of the uneven nuclei rubidium-105 and rubidium-107 also gave strong indications of rotational bands; comparison of the rubidium-107 line potential with the Nilson diagram pointed to a cigar-shaped deformation. The rubidium-105 nucleus became only deformed during excitation and exhibited a 0.3 deformation parameter. It was concluded that a region of deformed nuclei exists between isotopic rubidium-105 and rubidium-110.
Transl. by G.G.

N70-18529# Texas Univ., Austin. Center for Nuclear Studies.
NUCLEAR STRUCTURE STUDIES FROM PROTON AND DEUTERON INDUCED REACTIONS ON Xe-136
P. A. Moore, P. J. Riley, C. M. Jones, M. D. Mancusi, and J. L. Foster, Jr. (Pittsburgh Univ.) Oct. 1968 281 p refs Prepared in cooperation with ORNL
(ORO-2972-87; TR-5) Avail: CFSTI

Proton and deuteron induced reactions on Xe-136 were analyzed to obtain nuclear structure information for the Xe-135, Xe-136, and Xe-137 isotopes. Isobaric analogue resonances in the proton elastic excitation functions were fitted using the shell model approach to reaction theory to extract quantitative nuclear structure information for the parent analogue states in Xe-137. The results of the elastic analysis are compared with a DWBA analysis of the angular distributions and the two analyses are found to be in excellent agreement. In all, 24 levels of Xe-137 were identified in the combined analyses, and spins, parities, and spectroscopic factors were determined for many of these states. A DWBA analysis of the angular distributions was also carried out, providing information on the structure of three levels of the Xe-135 nucleus. Thirty-six levels of Xe-136 were identified in the proton inelastic scattering data.
Author (NSA)

N70-18580*# Syracuse Univ. Research Corp., N.Y. Materials Science Lab.
AN EXTREME ULTRAVIOLET PHOTOEMISSION STUDY Final Report
Robert M. Finn 10 Dec. 1969 34 p refs
(Contract NSR-33-144-002)
(NASA-CR-107674) Avail: CFSTI CSCL 20H

The photoemissive properties of Fe, Mo, Cu, Ni, and Al were investigated at the wavelengths 584 A and 1216 A. Both the photoelectric yield and the energy distribution of emitted electrons were correlated with the defect concentrations existing in these samples. The yield of Al at 584 A decreased monotonically, while that for Al at 1216 A went through an obvious maximum before decreasing. The yield of Ni at 1216 A varied unpredictably, though it tended toward lower values with increasing defect concentration. Other yields were approximately constant, though the observations cannot be considered final because of limitations in the experimental approach. These are discussed, and some general effects are described, as are the needed remedies. The electron energy spectra were determined to be relatively independent of dislocation density except for the very obvious changes apparent in Mo at 1216 A. The observed variations were too large to be attributed to instrumental uncertainties, and do represent real effects.
Author

N70-18583# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Nuclear and Radiation Physics Section.

THE LITHIUM MICROPROBE AS A TOOL FOR HYDROGEN MICROANALYSIS AT SURFACES

Gerald M. Padawer and Edward J. Schneid Dec. 1969 47 p refs Presented at the Am. Nuclear Soc. Winter Meeting, San Francisco, 30 Nov.– 4 Dec. 1969

(RM-467J) Avail: CFSTI

The feasibility of utilizing the H-1(Li-7, gamma)Be-8 resonant nuclear reaction to measure the concentration profile of hydrogen at the surface of a solid. By bombarding suitable titanium targets with lithium-7 ions between 2.7 MeV and 6.3 MeV, we were able to measure the hydrogen distribution in these specimens to a depth of 5 microns, with a resolution of 0.1 micron. This method may prove useful as a diagnostic tool in studies of hydrogen-embrittlement problems relating to aerospace metals. Author

N70-15647# Nagoya Univ. (Japan). Dept. of Physics.

ON QUANTUM MECHANICS OF IDENTICAL PARTICLES

Y. Ohnuki and S. Kamefuchi [1969] 53 p refs Prepared in cooperation with Tokyo Univ. of Educ.

(TUEP-69-18) Avail: CFSTI

The statement commonly made in the quantum mechanical theory of identical particles that the characters of the symmetric group of particle permutations are constants of motion is shown not to be always correct when paraparticles come into play. A general quantum mechanical theory which can as well deal with paraparticles is formulated on the basis of the corresponding parafield theory. It is shown that to describe such a general system, a multi-component wave function is needed, with each component referring to each inequivalent irreducible subspace under particle permutations, and consequently that physical observables have the corresponding matrix-like structure. General properties of the given formalism are studied in detail, and its connection with the usual formalism clarified. A further generalization of the given formalism to include particles which do not obey parastatistics is also discussed. Author

N70-15654# Nuclear-Chicago Corp., Austin, Tex. Nuclear Div.

NEUTRON INDUCED GAMMA-RAY PRODUCTION CROSS SECTION FOR SILICON AND TUNGSTEN Interim Report, May 1968 –May 1969

W. E. Tucker, P. S. Buchanan, T. C. Martin, D. O. Nellis, and G. H. Williams 30 May 1969 112 p refs

(Contract DASA01-68-C-0128)

(AD-694999; DASA-2333) Avail: CFSTI CSCL 20/8

Experimental measurements of the differential cross sections for the production of gamma rays in natural silicon and tungsten in the energy range from 5.0 to 11.0 MeV are presented. Theoretical calculations of the production cross sections for silicon, based on statistical theory and the Satchler formalism, with modifications by Moldauer, have been made, and comparisons of these calculations and other nuclear model calculations with experiment are discussed. Author (TAB)

N70-15747# Purdue Univ., Lafayette, Ind.

THE INTERACTION PICTURE FOR GRAVITY INTERACTING WITH FERMIONS

Michel Charles Bergere (Ph.D. Thesis) Jan. 1970 288 p

Avail: CFSTI

The interaction between gravitons and fermions is described by a Lagrangian function of the tetrad field and of the fermion field. It is more convenient to use the tetrad field instead of the metric field to describe the interaction because of our use of tetrads in the formation of the fermion Lagrangian density in curved space. A canonical formalism is developed defining field momenta and Hamiltonian operators on a spatial three-hypersurface. The dynamics of the system is given by the commutators of the fields and momentum with the Hamiltonian. Author

N70-15778# Nebraska Univ., Lincoln. Behlen Lab. of Physics.

FORMATION OF PARTICLE TRACKS

Robert Katz and E. J. Kobetich 24 Feb. 1969 19 p refs Presented at the Intern. Meeting on the Study of Charged Particle Tracks in Solid Insulators and Their Appl., Clermont-Ferrand, France, 6-9 May 1969; Sponsored Jointly by AEC and NSF

(COO-1671-18; Conf-690522-4) Avail: CFSTI

The formation of particle tracks, and such phenomena as the detection of charged particles and the damage produced by charged particles, are intimately related to the spatial distribution of ionization energy deposited by delta rays. Changes in the spectrum of delta rays with the velocity of the primary particle imply that linear measures of the interaction of the primary particle with the medium, such as specific energy loss, or primary ionization, are unsatisfactory measures of effects produced in the medium, for they contain no knowledge of the spatial deposition of the lost energy. Author (NSA)

N70-15782# Stanford Univ., Calif. High Energy Physics Lab.

OBSERVATIONS ON THE TOTAL ABSORPTION OF ELECTRONS AND PIONS IN MATTER AT GeV ENERGIES

E. B. Hughes Jun. 1969 39 p refs Presented at the Washington of the Am. Phys. Soc., Apr. 1969

(Contract Nonr-225(67))

(AD-695419; SU-HEPL-603) Avail: CFSTI CSCL 20/8

General remarks are given on the subject of total absorption, then indicate why such observations were pursued into the GeV range, and finally the observations themselves are discussed and what have been learned from them. For both electrons and pions the principal concern was to determine the spatial distribution of the energy deposited within an absorber, on the one hand by the electromagnetic cascade and on the other by the nucleon-meson cascade; or alternatively to determine the size and shape of the absorber needed to contain a specific fraction of the incident energy. This goal can be contrasted with the interest in this problem of the designer of a radiation shield who might be more concerned with the numbers of secondary particles emerging at large depths from the absorber. Author (TAB)

N70-15790# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Nuclear and Radiation Physics Section.

PROTON MICROPROBE ANALYSIS OF THE SURFACE OF STRANDED WIRE IN THE LUNAR MODULE

Gerald M. Padawer Dec. 1969 28 p refs

(RM-462) Avail: CFSTI

The nuclear microprobe technique was used to measure the fluorine concentration to a depth of 0.8 x 10 to minus 4th power cm within the surface of a specimen of silvercoated copper wire on the Lunar Module (LM). The integrated fluorine concentration within this depth was found to be (1.1 + or – 0.2) x 10 to minus 6th power gram cm to minus 2nd power. For depths between 0.1 x 10 to minus 4th power cm and 0.8 x 10 to minus 4th power cm, the concentration profile satisfies the function in centimeters. If this distribution prevails as well for depths beyond 0.8 x 10 to minus 4th power cm, we can assign an upper limit of 1.9 x 10 to minus 6th power gram - cm to minus 2nd power to the integrated fluorine concentration. Author

N70-15822# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.

DUALITIES IN BARYON-ANTIBARYON SCATTERING

Ken Kawarabayashi, Shinsaku Kitakado, and Haruichi Yabuki Nov. 1969 47 p refs

(RIFP-97) Avail: CFSTI

Discussions are given of possible solutions for the finite energy sum pulses (FESR) applied to baryon anti-baryon scattering, with or without assuming resonances in exotic channels. Exotic resonances, assuming they exist, are classified, as a result of factorization, according to 36-plet, 18-plet, anti-18-plet and nonet.

It is then shown that these mesons are required to obey an equal spacing mass formula and nonet-like couplings, which are direct extensions of the ideal nonet scheme for 1(-) and 2(+) mesons. When there are no resonances in exotic channels, the idea of duality between ordinary meson resonances is not applicable to baryon-antibaryon scattering. However, by extending the concept of the duality, it is possible to find a solution of the FESR. An explicit formula with such extended duality is constructed, where Regge cuts as well as Regge poles appear in the amplitude in question. Author

N70-15824# California Univ., Livermore. Lawrence Radiation Lab.
THRESHOLD PHOTONEUTRON CROSS SECTIONS AND ANALOG STATES
B. L. Berman, R. J. Baglan, and C. D. Bowman 27 Jun. 1969 8 p ref Presented at the Gordon Conf. for Photonuclear Reactions, Tilton, N.H. Sponsored by AEC
(UCRL-71831) Avail: CFSTI

The threshold photoneutron cross sections of Cr-52, Fe-56, and Mg-25 were measured at 135 deg in order to determine the isobaric analog excitation energies. For Cr-52 and Fe-56, the spectra were very rich and relatively few T> levels were seen in the many T< levels. For Mg-25, the T = 3/2 analog of Na-25 was identified at an excitation energy in Mg-25 of 7.8728 + or - 0.0030 MeV. NSA

N70-15826# Illinois Univ., Urbana. Dept. of Physics and Materials Research Lab.
SENSITIVITY OF NUCLEAR MAGNETIC DOUBLE RESONANCE
Paul Roger Spencer (Ph.D. Thesis) Oct. 1969 121 p refs
(Contract AT(11-1)-1198)
(COO-1198-663) Avail: CFSTI

The dynamics of the nuclear magnetic double resonance process for Na nuclei in a (2,0,0) position relative to a substitutional Ag(+) impurity in NaCl was studied for several Ag concentrations. The factors which limit the double resonance sensitivity were determined. For Ag concentrations below 0.03 mole %, the magnetization of unperturbed Na nuclei decayed exponentially with rates proportional to the impurity concentration when an rf field at the resonance frequency of the quadrupole shifted transitions was applied. Using a new method, intermittent search field irradiation, evidence was found that the finite spin diffusion rate caused a double resonance energy transfer rate under continuous search field irradiation about 30% less than the transfer rate which would be observed if the spin diffusion were infinitely fast. A theoretical explanation of the results is given using a perturbation approach. Author (NSA)

N70-15831# Oak Ridge National Lab., Tenn.
GROUND HEATING DUE TO A POINT SOURCE OF 12.2 TO 15-MeV NEUTRONS AT AN ALTITUDE OF 50 FEET
E. A. Straker, M. B. Emmett, and C. L. Thompson 19 Aug. 1969 25 p refs Supported by DASA
(ORNL-TM-2587) Avail: CFSTI

Heat deposited in the ground as a function of range, ground depth, and time due to the neutrons and their secondary gamma rays from a 12.2- to 15-MeV neutron source was determined. The source was situated at an altitude of 50 feet above the ground in air of uniform density (1.10 gm/l). Both Monte Carlo and discrete ordinates methods were used to transport the neutrons and gamma rays through the atmosphere and into the ground. The importance of low-energy neutrons and the secondary gamma rays to the total heat deposited is shown. Author (NSA)

N70-15832# Oak Ridge National Lab., Tenn. Neutron Physics Div.
PHOTONUCLEON AND PHOTOPION PRODUCTION FROM HIGH-ENERGY (50 TO 400 MeV) ELECTRONS IN THICK COPPER TARGETS
T. A. Gabriel and R. G. Alsmiller, Jr. Sep. 1969 51 p refs
(Contract W-7405-eng-26)
(ORNL-4443) Avail: CFSTI

Electron-photon cascade calculations were carried out for high-energy electrons incident in a thick (infinite) copper target. The photon track length per unit energy from these calculations was used in conjunction with a recently developed model of photonucleon and photopion production from photon-nucleus collisions to calculate the energy and angular distributions of high-energy photonucleons and photopions produced when electrons in the energy range 50 to 400 MeV are incident on a thick copper target. Author (NSA)

N70-15833# Stanford Univ., Calif. Nuclear Engineering Lab.
STUDY OF FISSION-FRAGMENT-INDUCED NUCLEATION OF BUBBLES IN SUPERHEATED WATER
L. W. Deitrich Apr. 1969 107 p refs
(Contract AT(04-3)-326)
(SU-326-P-13-4) Avail: CFSTI

Two theories proposed to explain the ability of radiation particles to produce bubbles in superheated water are that a bubble is created as a result of electrostatic repulsion between like-charged ions within a small cavity left by the particle traversing the liquid and that bubble formation is due to thermal energy deposited in the liquid as a thermal spike by the ionizing particle. The spike theory was applied to calculations in the experiment. The design and performance of the bubble chamber facility and auxiliary equipment are given. The experimental data are compared with the theoretical calculations. A 235UO2 source was irradiated with neutrons from a reactor beam port at the Stanford Pool Reactor. NSA

N70-15835# Yale Univ., New Haven, Conn.
INELASTIC ELECTRON SCATTERING FROM Zr-90
C. K. Bockelman, T. H. Curtiss, R. A. Eisenstein, and D. W. Madsen 1969 1 p Presented at the Intern. Conf. on Properties of Nucl. States, Montreal
(CEA-CONF-1323; CONF-690804-4) Avail: CFSTI

The collective states of zirconium-90 were studied with the 70-MeV electron linac at Yale University. At low energies such measurements determine by a unique way the reduced transition probabilities. For Zr-90 these B(EL) values compare to those given by a R.P.A. description of vibration for even isotones. Measurements were carried out on an enriched target of Zr-90 using 58-MeV electrons. The momentum transfer varied from 0.3 to 0.6 f-m. The total energy resolution was 120 keV. The prominent peaks at 2.18, 2.74, and 3.84 MeV are known to be 2(+), 3(-), and 2(+), respectively. A distorted wave calculation was used to analyze the inelastic data. NSA

N70-15837# Oak Ridge National Lab., Tenn.
HELENE: A COMPUTER PROGRAM TO CALCULATE NUCLEAR CROSS SECTIONS EMPLOYING THE HAUSER-FESHBACH MODEL, PORTER-THOMAS WIDTH FLUCTUATIONS, AND CONTINUUM STATES
S. K. Penny 18 Aug. 1969 35 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2590) Avail: CFSTI

HELENE is a computer program, written in FORTRAN, with which one may calculate the differential cross sections for scattering and reactions which proceed through a compound nucleus. The code is limited to binary reactions, but includes a means of calculating capture and a partial disappearance to take into account fission, etc. Continuum states can be included in competition with discrete states. Author (NSA)

N70-15839# Brookhaven National Lab., Upton, N.Y. Information Div.
THE EFFECT OF FLUCTUATIONS OF THE PARTIAL

WIDTHS ON THE COMPETITION BETWEEN FISSION AND INELASTIC SCATTERING

N. S. Rabotnov Jun. 1969 10 p refs Transl. into ENGLISH from Yadern. Fiz., (USSR), v. 9, Apr. 1969 p 775–778
(BNL-TR-275) Avail: CFSTI

Fluctuations of fission and neutron widths around the mean values may in some cases influence qualitatively the results of analysis of the energy dependence of fission cross section for threshold elements. In the subthreshold region near the level of inelastic scattering some approximate relations are obtained. The relations indicate that at a small ratio of mean widths of inelastic and elastic neutron scatterings the competition of the inelastic scattering influence the fission cross sections much more essentially than may be expected from the observable excitation functions of the inelastic scattering. Author (NSA)

N70-15847# Battelle-Northwest, Richland, Wash.
INTERCALIBRATION OF COUNTING LABORATORIES

J. A. Ulseth Aug. 1969 8 p
(Contract AT(45-1)-1830)
(BNNL-1096) Avail: CFSTI

Eleven major radioisotope counting laboratories have participated in an intercalibration test to determine the degree of consistency among the laboratories in measuring activations from the Fe-54 (neutron,proton) Mn-54, Ti-46 (neutron,proton) Sc-46, Ni-58 (neutron,proton)Co,58, and Co-59(neutron,gamma-meson)Co-60 reactions. The counting results of this test compare favorably with a similar test conducted in 1963 with the exception of results for the Ni-58(neutron,proton)Co-58 reaction where the standard deviation among laboratories has slipped from + or – 2.6% to + or – 4.2%. The laboratories were also asked to calculate fast and thermal fluence values from the activities. In determining fluence from these monitors, the laboratories were consistent only for thermal fluence (standard deviation of 8%). Author (NSA)

N70-15848# Battelle-Northwest, Richland, Wash.
HIGHLY ENRICHED U-A1, 0.95 WT PERCENT ENRICHED URANIUM, AND LIA1 TARGET SUPERCELL: PCTR EXPERIMENTS

Darrell F. Newman and Hidehiko Mitsui Jul. 1969 97 p refs
(Contract AT(45-1)-1830)
(BNWL-1029) Avail: CFSTI

A highly enriched Al–U, 0.95 wt % enriched uranium, and Al–Li target supercell lattice has been investigated in the physical constants testing reactor (PCTR). Neutron multiplication factors, utilization ratios, fast fission factors, resonance escape probabilities, and absorption ratios for U-238 and Li-6 relative to U-235 have been inferred from null reactivity experiments and measurements of the spatial distributions of neutron reaction rates. Microscopic neutronic parameters measured in the supercell lattice are reported. Experiments were performed at room temperature in a graphite moderated six-by-six cell array placed in the cavity of the PCTR, both with and without light water in the supercell lattice coolant channels. Author (NSA)

N70-15854# California Inst. of Tech., Pasadena.
SELECTION RULES FOR DIFFRACTION DISSOCIATION

S. F. Frautschi Jul. 1969 19 p refs
(Contract AT(11-1)-68)
(CALT-68-220) Avail: CFSTI

The possible application of several types of selection rules to diffraction dissociation is discussed. The one-photon exchange diagram for e + A yields e + a, A yields B + gamma, A + B yields gamma, for dipole rules; Morrison's rule delta P = (–1)(delta J) for a + b yields c + d inelastic interactions in which m sub a does not equal m sub c; and quark model rules for the diffraction dissociation a + b yields c + b are covered. NSA

N70-15866# Princeton-Pennsylvania Accelerator, Princeton, N.J.
THE PRINCETON PENNSYLVANIA RAPID CYCLING, 3 GeV PROTON SYNCHROTRON: RECENT IMPROVEMENTS AND FUTURE PLANS

J. L. Kirchgessner 12 Aug. 1969 14 p refs Presented at the 7th Intern. Conf. on High Energy Accelerators, Moscow
(Contract AT(30-1)-3217)
(PPAD-662-E; CONF-690811-9) Avail: CFSTI

The present operation of the Princeton-Pennsylvania Accelerator is briefly outlined. Some of the design modifications underway for improving duty factor, deuteron and alpha acceleration, accelerator tube for the Van de Graaff, and beam current are discussed. The short and long range plans of the accelerator are included. NSA

N70-15868# California Inst. of Tech., Pasadena.
DUALITY

S. Frautschi Jul. 1969 22 p refs
(Contract AT(11-1)-68)
(CALT-68-218) Avail: CFSTI

The discussion of duality is based on a previous approach, and various simplifications are made. A spinless reaction is considered. Proliferation and escalation are avoided by the conditions that all particles lie on linear trajectories with the same slope. A general formula is given and applied to the case of some channels which communicate with the tau meson and f sub 0 trajectories. The interaction pion + pion yields pion + pion is considered. Other aspects covered are the conditions for duality, the equivalence of a certain set of exchange diagrams with a certain set of resonance diagrams, exchange degeneracy, dips, and the status of Pomeranchon. NSA

N70-15870 International Atomic Energy Agency, Vienna (Austria).
AN INTERNATIONAL NEUTRON DATA SYSTEM

Nov. 1969 41 p Presented at IAEA Conf., Brookhaven N.Y., 10–14 Feb. 1969 *Its* Tech. Rept. Ser. No. 100
(STI/DOC/10/100) Copyright. Avail: Issuing Activity $0.65

The findings of the panel are presented on data compilation needs and the role and development of data centers. It was recognized that bibliographic indexing and numerical data compilation should continue for the foreseeable future. The short term problems to be considered are identified as definition and classification of neutron reactions; characterization of experimental data/implementation of the second generation compilation, storage, and retrieval system; indexing, reviewing, evaluating, and disseminating data; and publicizing the centers' activities. Considerations for long range developments are mentioned, and recommendations are summarized. N.E.N.

N70-15882# Princeton-Pennsylvania Accelerator, Princeton, N.J.
REMARKS ON THE REACTION PROTON + DEUTERON YIELDS NEUTRAL Xi HYPERON + He-3: NEW PROBES OF NUCLEAR CORRELATIONS CORRELATIONS AT SMALL DISTANCES AND SU(3) SYSTEMATICS

Saul Barshay 25 Aug. 1969 8 p
(Contract AT(30-1)-2137)
(PPAR-23) Avail: CFSTI

The possible experimental investigation of the interaction p + d yields X(0) + He(3) at high energies is considered. The kinds of information which can be obtained from this study are discussed. NSA

N70-15897# Brookhaven National Lab., Upton, N.Y.
NUCLEAR AND PHYSICAL PROPERTIES OF Cf-252

A. Prince Apr. 1969 91 p refs
(BNL-50168) Avail: CFSTI

A review of the nuclear and physical properties of Cf-252 is presented. Experimental and calculated data on decay properties, alpha activity, and spotaneous fission include mass distribution, kinetic energy of fission fragments, energy and angular distribution of neutrons, nuclear charge distribution, prompt and delayed

neutrons and gamma rays, and tri-partition of k-x-rays. Neutron induced reactions are also investigated, and experimental and estimated values of the thermal capture and fission cross sections as well as the capture and fission resonance integrals are given, along with the average number of prompt neutrons per neutron induced fission. The high energy (1 keV to 15 MeV) cross sections for all neutron induced reactions are calculated using a coupled channel analysis. Author (NSA)

N70-15898# Brookhaven National Lab., Upton, N.Y.
PLACEMENT OF AN ELECTROSTATIC DEFLECTOR FOR THE SLOW EXTERNAL BEAM IN THE AGS
J. W. Glenn 27 Aug. 1969 13 p
(BNL-13987) Avail: CFSTI

The characteristic of nonlinear growth rate associated with subintegral extraction allows an enhancement of the splitting caused by a deflector used to separate part of the beam into an extraction channel. The third subintegral resonance is discussed and numerical results using the AGS Beam Program are presented. These results indicate the new electrostatic thin septum deflector for the slow beam should be located in the H20 straight section. Possible usage of the septum for the I10 fast beam is discussed. Author (NSA)

N70-15901# Argonne National Lab., Ill.
FAST-NEUTRON CROSS SECTIONS OF HAFNIUM, GADOLINIUM, AND SAMARIUM
G. L. Sherwood, A. B. Smith, and J. F. Whalen
(Contract W-31-109-eng-38)
(AL-7567) Avail: CFSTI

Elastic and inelastic neutron-scattering cross sections of elemental hafnium, gadolinium, and samarium were measured at incident neutron energies of 0.3 to 1.5 MeV. The experimental resolution was sufficient to reasonably resolve elastic and inelastic processes and to define individual inelastic cross sections for the most appreciably excited states. The total neutron cross sections were determined up to 1.5 MeV with resolutions of approximately 2.5 keV. Within the precisions of the measurements, all observed cross sections were relatively smooth functions of energy. The experimental results were compared with those obtained from calculations based upon both spherical and deformed optical potentials and statistical theory, inclusive of fluctuation corrections. The calculated results were descriptive of measured total, elastic scattering, and, to a lesser extent, inelastic scattering cross sections. Author (NSA)

N70-15907# Washington Univ., Seattle.
COMPETITION BETWEEN NEUTRON EMISSION AND FISSION AT MODERATE EXCITATION ENERGIES IN THE URANIUM REGION
Charles Joseph Bishop (Ph.D. Thesis) 1969 104 p refs
Sponsored by AEC
(RLO-1388-99) Avail: CFSTI

The ratio of the probability of neutron emission to the probability of fission was studied to determine its dependence on excitation energy of the compound nucleus. The experimental method used involves detecting neutrons in coincidence with fission fragments at 0 to 90 deg with respect to the fragments. Prefission neutrons are isotropic while post-fission neutrons are highly correlated with the fragment direction. U-233 and U-238 were bombarded with 11.5 to 22-MeV protons and post-fission/pre-fission neutron ratios determined. Cf-252, a spontaneous fissioning nuclide, was also studied. Author (NSA)

N70-15918# Oregon State Univ., Corvallis. Dept. of Physics.
NUCLEAR PHYSICS GROUP Annual Progress Report for Period Ending 31 Jul. 1969
31 Jul. 1969 82 p refs
(Contract AT(45-1)-1062)
(RLO-1062-691) Avail: CFSTI

This report summarizes the research effort and technical progress of the Nuclear Physics Group of the Department of Physics of Oregon State University for the one-year period ending July 31, 1969. The work described includes the investigations in the beta-gamma spectroscopy group, theoretical nuclear studies, some nuclear interaction studies, and the status of the cyclotron modification. Author (NSA)

N70-15923# Argonne National Lab., Ill.
THICKNESS CORRECTIONS FOR NEUTRON-ACTIVATED GOLD FOILS
George S. Stanford and James H. Seckinger (M.S. Thesis-Vanderbilt Univ.) Feb. 1969 78 p refs
(Contract W-31-109-eng-38)
(ANL-7545) Avail: CFSTI

Curves for determining thickness-correction factors for treating counting data for sets of neutron-activated, unmatched gold foils have been determined experimentally, by using the first derivative of the curve of activation versus thickness. This was done for both epithermal and thermal activation of gold foils irradiated in a near-isotropic flux in a void in a graphite thermal column. The epithermal activation agreed well with a published theoretical calculation. To obtain a differentiable curve from the activation data, a computer code was written to perform a least-squares fitting process to obtain the coefficients for the equation where A(t) is the specific activation of a foil of thickness t, and f(t) is a differentiable function with a theoretical basis for being at least an approximate fit to the data. For the epithermal data, the calculated self-shielding function for a single-resonance approximation was used for f(t). For the thermal case, f(t) was taken to be the standard thermal self-shielding function. Author (NSA)

N70-15926# Japan Atomic Energy Research Inst., Ibaraki, Tokai Research Establishment.
NUCLEAR PHYSICS IN ENERGY REGION OF TANDEM ACCELERATORS
Michio Maruyama, ed. and Shiroh Kikuchi, ed Apr. 1969 156 p refs Held at Ibaraki, Japan, 19-21 Dec. 1968 In JAPANESE; ENGLISH summary
(JAERI-1184) Avail: CFSTI

Conference proceedings pertained to the status and use of tandem accelerators, optical models, nuclear transfer reactions, isobaric analog states, and compound nuclear reactions. For individual titles, see N70-15927 throuh N70-15957.

N70-15927# Japan Atomic Energy Research Inst., Ibaraki.
TOPICS ON THE TANDEM ACCELERATOR
Kineo Tsukada *In its* Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 1-5 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Development of the large tandem accelerator and prospective researches on the heavy ion reactions are described. Author

N70-15928# Kyoto Univ. (Japan).
ON THE KYOTO-UNIVERSITY TANDEM VAN de GRAAFF
Jiro Muto *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 6 In JAPANESE; ENLISH summary (See N70-15926 05-24)
Avail: CFSTI

Technical experience on the Kyoto University Tandem Van de Graaff Accelerator is presented. The quality of ion beams by the use of gas strippers as contrasted with the use of foil strippers is described. Author

N70-15929# Kyoto Univ. (Japan).
CONTROL OF BEAM TRANSPORT SYSTEM
Isao Kumabe *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 7-10 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)

Avail: CFSTI

Three new control methods for steering accelerator beams in a particle accelerator are presented. Author

N70-15830# Kyushu Univ., Fukuoka (Japan).
CHARGE EXCHANGE STUDIES OF TANDEM ACCELERATORS
Hiroyuki Tawara *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 11–17 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Results of the charge exchange studies with tandem accelerators are presented. The charge exchange of low energy helium ions in various alkali vapors for the production of intense negative helium ions and examples of negative helium ion sources with lithium vapor electron adder are described. The multiple acceleration system of heavy ions with tandem accelerators based on target density effect is discussed. Author

N70-15831# Tokyo Univ. (Japan). Tandem Group.
THE UNIVERSITY OF TOKYO TANDEM MACHINE
Noriyuki Takahashi *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 18 In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Present performances of the University of Tokyo Tandem Particle Accelerator are presented. Author

N70-15832# Tokyo Univ. (Japan).
NUCLEAR PHYSICS USING THE TANDEM ACCELERATOR IN HEIDELBERG
Toru Nomura *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 19–24 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Experiments carried out using the tandem accelerator of the Max-Planck-Institute for Nuclear Physics, Heidelberg are discussed. Experiments conducted were, (1) gamma-rays following heavy ion bombardment of light nuclei, (2) measurement of static quadrupole moment by coulomb excitation, (3) test of T-variance from compound reactions, and (4) heavy-ion transfer reactions with identical and final states. Author

N70-15933# Osaka Univ. (Japan).
ANALYSIS OF THE HEAVY ION INDUCED TRANSFER REACTIONS
Tetsuo Kammuri *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 25–29 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Analysis of heavy ion induced transfer reactions by use of finite range DWBA method is described. Author

N70-15934# Tokyo Univ. (Japan).
STRUCTURE OF sd-SHELL NUCLEI
Akito Arima *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 30–35 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Applications of conventional shell models to calculate properties of shell nuclei are presented. Considerations for correcting characteristic discrepancies are discussed. Author

N70-15935# Kyoto Univ. (Japan).
EXPERIMENTAL RESEARCHES AT RUTGERS
Hiroshi Ogata *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 36–38 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

The tadem Van de Graaff Accelerator and experimental programs at Rutgers University are described. Author

N70-15936# Tokyo Ist. of Tech. (Japan).
TOPICS IN OPTICAL MODEL OF NUCLEAR REACTIONS
Mitsuji Kawai *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 39–48 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Developments in the derivation of optical potential parameters for nucleon–nucleus scattering from the two body nuclear forces are discussed. An argument in favor of the assumption of non-polarization of the target nucleus is given in terms of the coupled channel calculation. Possible sources of error in using the shell model T-matrix as the effective two body interaction are pointed out. An optical model for deuterons is discussed. Author

N70-15937# Hosei Univ., Tokyo (Japan).
COUPLED CHANNEL CALCULATION FOR THE ELASTIC PROTON SCATTERING BY C-12
Osamu Mikoshiba (Tokyo Coll. of Sci.), Maroto Tanifuji, and Tokuo Terasawa *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 49–51 refs In JAPANESE; ENGLISH summary Prepared in cooperation with Tokyo Univ. (See N70-15926 05-24)
Avail: CFSTI

The elastic scattering of protons by Carbo 12 and several intermediate resonances are presented. Analyses of the elastic scattering data have been performed in terms of the coupled channal calculation with a realistic generalized optical potential. Preliminary results and comments for further developments are presented. Author

N70-15938# Japan Atomic Energy Research Inst., Ibaraki.
NOTE ON THE OPTICAL POTENTIALS FOR COMPOSITE PARTICLES
Kichinosuke Harada *In its* Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 52–58 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

The theoretical estimation of the optical potential for a composite particle, the distortion, and the dissociation effects of the projectile are presented. Written calculated the real part of the optical potential for alpha nucleus scattering taking these effects into account. In the first part of this note his paper is reviewed briefly. In the second part, the real part of the optical potential for three nucleon system is calculated with his method. Author

N70-15939# Tokyo Inst. of Tech. (Japan).
A COMMENT ON THE DEUTERON OPTICAL POTENTIAL
Hisbo Furukawa and Mitsui Bawai *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 57–61 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

The deuteron optical potential with a specific spin orbit potential is discussed. Optical potentials were used in the DWBA calculations of cross sections and proton polarizations for several materials. Author

N70-15940# Tokyo Univ. (Japan). Inst. for Solid State Physics.
NEUTRON DEPOLARIZATION IN THE ELASTIC SCATTERING AND THE SPIN–SPIN INTERACTION
Kenji Katori *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 62–65 refs In JAPANESE; ENGLISH summary (See 70-15926 05-24)
Avail: CFSTI

Neutron depolarization in the elastic scattering has been measured for non-zero spin targets in order to investigate the target spin dependent interaction in the optical potential. The evidence for spin-spinteraction is established. The mass and target spin strength dependence seems not to be found in a spin–spin interaction. The interaction seems to be dependent on the ground state configuration of an individual nucleus. Author

N70-15941# Kyoto Univ. (Japan).
TWO NUCLEON TRANSFER REACTION
Takeshi Udagawa *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 67–71 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Nuclear structure information obtained from the two nucleon transfer reaction is discussed. Author

N70-15942# Tokyo Univ. (Japan). Inst. for Nuclear Study.
PROPERTIES OF THE PRODUCT OF INITIAL AND FINAL DISTORTED-WAVES IN (t,p) REACTION
Ken-Ichi Kubo *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 72–78 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

The features of the product of distorted waves in both channels according to the selection rule of angular momentum are presented. Comparison is made with the form factor and peak and valley features of angular distribution of protons. Author

N70-15943# Japan Atomic Energy Research Inst,, Ibaraki. Inst. of Physical and Chemical Res.
(He-3,p) REACTIONS
Kazuhisa Matsuda *In its* Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 79–82 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Experimental results for the nuclear reactions of carbon and aluminum isotopes are presented. The isotopic spin dependence on the two nucleon transfer reaction is presented according to the stripping and pick up theory. Author

N70-15944# Tokyo Univ. (Japan).
THE (He-3,p) REACTIONS ON LIGHT NUCLEI AND THE ISOSPIN PAIRING COLLECTIVE EXCITATIONS
Noriyuki Takahashi and Yoseo Iwasaki *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 83–87 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

The neutron-proton correlations in light nuclei are discussed from the viewpoint of recent theoretical works. A possible new mode of collective excitation (isospin pairing mode) which might be observed in the neutron-proton transfer reactions is suggested. Author

N70-15945# Tohoku Univ., Sendai (Japan).
THE STRUCTURES OF Pr-141, Pm-143, AND In-117 BY (He-3,d) REACTIONS
Toshiyuki Ishimatsu *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 88–91 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Experiments of the helium ion reactions on various materials were made using the helium ion beam from a fixed frequency cyclotron. Deutrons from the targets were analyzed with a broad range magnetic spectrograph. Values of the orbital angular momentum transfer and the spectroscopic factor deduced from the Distorted Wave Born Approximation analysis of the angular distributions of these deuteron groups are consistent with the simple shell model picture. Author

N70-15946# Osaka Univ. (Japan). Dept. of Physics.
EFFECTIVE PROTON-NEUTRON INTERACTIONS IN THE NUCLEI OF A EQUALS 90–140
Kohsuke Yagi *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 92–95 refs (See N70-15926 05-24)
Avail: CFSTI

The Z dependence of neutron single hole (particle) energies in isotopes of Cesium, Tin, and Zirconium is presented on the basis of effective proton-neutron interactions. Author

N70-15947# Hosei Univ., Tokyo (Japan).
REMARKS ON ONE-NUCLEON-TRANSFER REACTIONS BY THE SUDDEN APPROXIMATION
Makoto Tanifuji and Hiroshi Nova *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 96–99 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Qualitative features were investigated for the (d,p) transition amplitude by the sudden approximation. The amplitude consists of the momentum distribution term studied in high energy (p,d) reactions. The numerical result on calcium isotope reactions is discussed. Author

N70-15948# Tokyo Inst. of Tech. (Japan).
ISOBARIC SPIN EFFECTS IN NUCLEAR REACTIONS
Hiroshi Taketani *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 101–112 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

Experimental aspects of the isobaric analog states in various nuclear reactions and transitions are presented. The use of analog states as a means of investigating nuclear structure is discussed. The splitting of reaction strengths in single nucleon transfer reactions on singly or doubly closed shell nuclei with sizeable neutron excess is discussed. Possible isobaric spin effects are suggested. Author

N70-15949# Tokyo Inst. of Tech. (Japan).
CONFIGURATION STATES IN (f,p) SHELLS
Takeshi Oda *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 113–114 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

The effective neutron-proton interaction making use of the core polarization is presented. Author

N70-15950# Tokyo Univ. (Japan). Inst. for Solid State Physics.
THE SPIN FLIP PROBABILITY AT THE ISOBARIC ANALOGUE RESONANCE
Kenji Katori *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 115 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

The spin-flip probability at isobaric analogue resonance is discussed. The measurement of the spin flip probability could provide new information on the properties of the isobaric analogue state. Author

N70-15951# Strasbourg Univ. (France).
M1 TRANSITIONS FROM ISOBARIC ANALOGUE STATE AND G-T BETA TRANSITIONS
M. Sakai, R. Bertini, and C. Gehringer *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 116–119 refs (See N70-15926 05-24)
Avail: CFSTI

High energy deexcitation gamma rays from the isobaric analogue states induced by reactions of isotopes of manganese and iron were measured with a Germanium-Lithium detector and results are presented. Author

N70-15952# Tokyo Univ. (Japan). Inst. for Nuclear Study.
GAMMA DECAYS OF ISOBARIC ANALOGUE STATES AND BETA DECAYS
Jun-Ichi Fujita *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 120–122 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

The measurement of gamma rays from isobaric analogue states as a method for obtaining information on corresponding beta decays is presented. Author

N70-15953# Tohoku Univ., Sendai (Japan).
ANALOG RESONANCE IN THE Se-77(p,p) REACTION
Seigo Kato *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 123–125 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)

The isobaric analog states of Selenium isotopes in Bromine isotopes are described. Although only particle states were seen, there is a possibility of observing pure collective excitation modes. Author

N70-15954# Tohoku Univ., Sendai (Japan).
INTERMEDIATE STRUCTURE IN THE Mg-24(d,p)Mg-25 REACTION
Sang-Moo Lee *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 126–130 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

A method of separating experimentally an intermediate structure from the cross section fluctuations are discussed. Author

N70-15955# Kyoto Univ. (Japan). Inst. for Chemical Research.
NUCLEAR RELAXATION AND ITS ANALOGY IN THE PROPERTIES OF BULK MATERIAL
Takuji Yanabu *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 131–140 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

The nuclear reaction mechanism is reviewed from the standpoint of its time sequence. The similarity between the nuclear relaxation of visco elastic materials is noted. The response characteristics of the nucleus to the pulse action of the incident particle are discussed referring to the recent development in the field of computer experiments on the equilibrium attainment of many particle systems. Author

N70-15956# Japan Atomic Energy Research Inst., Ibaraki.
REACTION TIME MEASUREMENT BY USING BLOCKING EFFECTS IN SINGLE CRYSTALS
Michio Maruyama, Kineo Tsukada, Kunio Ozawa, Fumnori Fujimoto (Tokyo Univ.), Kenichiro Komaki (Tokyo Univ.) et al *In its* Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 141–145 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

A new method of reaction time measurement by using blocking effects of energetic charged particles in single crystals is presented. Author

N70-15957# Tohoku Univ., Sendai (Japan).
INVERSE PHOTONUCLEAR REACTION
Eiji Tanaka *In* JAERI Nucl. Phys. in Energy Reg. of Tandem Accelerators Apr. 1969 p 146–149 refs In JAPANESE; ENGLISH summary (See N70-15926 05-24)
Avail: CFSTI

A brief review and comments on the inverse photonuclear reaction are presented. Author

N70-15973# California Univ., Berkeley. Lawrence Radiation Lab.
ASYMMETRY PARAMETERS IN NEGATIVE SIGMA HYPERON YIELDS NEUTRON PLUS BETA PLUS ANTINEUTRINO AND POSITIVE SIGMA HYPERON YIELDS PROTON PLUS GAMMA
Lawrence Kenneth Gershwin (Ph.D. Thesis) 2 Jun. 1969 117 p refs
(Contract W-7405-eng-48)
(UCRL-19246) Avail: CFSTI

Thirteen million pictures were taken of the interactions of a negative kaon beam ranging in momentum from 270 to 470 MeV/c, with most of the pictures taken in the vicinity of 390 MeV/c, where the Y*(1520) resonance is formed. The interference of the resonant amplitude with those of the predominantly S-wave background produces polarized sigma hyperons in the reactions negative Kaon pion yields negative Sigma hyperon positive pion and negative Kaon pion yields positive Sigma hyperon negative pion. It was found that both the branching ratio and asymmetry parameters are in agreement with some theoretical calculations, although the asymmetry parameter is two standard deviations from the value alpha = 0 predicted by SU(3) invariance. Author (NSA)

N70-15978# Oak Ridge National Lab., Tenn.
ANALYTIC REPRESENTATION OF PHOTONUCLEON AND PHOTOPION DIFFERENTIAL YIELDS RESULTING FROM HIGH-ENERGY ELECTRONS (50 < OR = E SUB ZERO < OR = 400 MeV) INCIDENT ON AN INFINITE COPPER TARGET
T. A. Gabriel Sept. 1969 31 p refs
(Contract W-7405-eng-26)
(ORNL-4442) Avail: CFSTI

Analytic fits of the Monte Carlo calculated differential photoparticle yields when electrons of energy 50, 100, 200, 300, and 400 MeV are incident on a infinite copper target were obtained by the method of linear least squares. For all of the above-mentioned electron energies, analytic expressions are given for the photoproton, photoneutron, and photopion differential yields in the target in the laboratory angular intervals defined by the incident electrons of 0 to 30, 30 to 60, 60 to 90, 90 to 120, 120 to 180, and 0 to 180 degrees. Author (NSA)

N70-15987# Stanford Univ., Calif. High Energy Physics Lab.
ELASTIC ELECTRON SCATTERING EXPERIMENTS WITH N 15
E. B. Dally, M. G. Croissiaux, and B. Schweitz (Inst. de Recherches Nucleaires, Strasbourg) May 1969 22 p refs Submitted for publication
(Contract Nonr-225(67))
(AD-695417; SU-HEPL-582) Avail: CFSTI CSCL 20/8

The nucleus of N15 was investigated by the electron scattering technique at incident energies of 250 and 400 MeV. The first diffraction minimum was observed and measured. The data were analyzed by using two nuclear charge density distributions; the Fermi model and the shell model. A value for the radius and skin thickness of the N15 nucleus is given although the data do not fit the diffraction minimum. Author (TAE)

N70-15993# Iowa State Univ. of Science and Technology, Ames.
THE EFFECTS OF NEUTRON IRRADIATION UPON THE STRENGTH AND DUCTILITY OF VANADIUM
G. R. Smolik and C. W. Chen May 1969 59 p refs
(Contract W-7405-eng-82)
(IS-2127) Avail: CFSTI

The effects of neutron irradiation on the mechanical properties of pure vanadium were investigated by examining the stress-strain curves of tensile samples of vanadium irradiated to various doses of fast neutrons. The changes in the yield strength and elongation to fracture are related to the fluence. The same parameters are evaluated as a function of post-irradiation annealing. Also, the influence of testing temperature on irradiation strengthening is examined. Of particular interest is the temperature dependence of the increase in the flow stress caused by neutron irradiation. The twinning behavior of irradiated vanadium is investigated in tensile tests conducted at liquid nitrogen temperature. NSA

N70-16028# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
ON THE BUNCH LENGTHENING EFFECT IN STORAGE RINGS
A. N. Lebedev (P. N. Lebedev Physical Inst., Moscow) 15 Jul. 1969 12 p refs *Its* Nota Interna No. 449
(LNF-69/52) Avail: CFSTI

The excitation of internal coherent synchrotron oscillations are considered as a possible origin of collective longitudinal

instabilities. Mathematical expressions are developed to describe the beam dynamics, the vacuum chamber impedance, and the instability increment. N.E.N.

N70-16032# International Centre for Theoretical Physics, Trieste (Italy).
MOMENTUM SPACE BHEAVIOUR OF INTEGRALS IN NON-POLYNOMIAL LAGRANGIAN THEORIES
Abdus Salam and J. Strathdee Sep. 1969 52 p refs Submitted for publication
(IC-69-120) Avail: CFSTI

Methods are developed for constructing momentum space amplitudes corresponding to non-polynomial interactions of a real scalar field. It is shown that the singularity structure of these amplitudes is likely to be consistent with unitarity. Asymptotic behavior both in space-like and time-like directions, is discussed. The methods used give rise to a super-graph technqiue and rules for writing down matrix elements very similar to Feynman techniques. Author (ESRO)

N70-16038# Iowa State Univ. of Science and Technology, Ames.
LATTICE DYNAMICS OF SCANDIUM
Nobuyoshi Wakabayashi Aug. 1969 124 p refs
(Contract N-7405-eng-82)
(IS-T-322) Avail: CFSTI

The phonon dispersion curves for scandium metal have been measured using the technique of inelastic neutron scattering. The triple axis spectrometer at the ALRR was used. A modified axially symmetric model involving interatomic force constants out to 6th neighbors has been fitted to the data and used to obtain a frequency distribution function for scandium metal. The Debye temperature calculated from this model is in reasonably good agreement with other experiments. All the interatomic force constants were found to be of the same order of magnitude except for the 4th neighbor force constants, indicating long range interactions between the atoms. The effect of the resolution ellipsoid on the peak shape of a scattered neutron group has been discussed in detail. A search has been made for paramagnon-like excitations associated with the conduction electrons at room temperature and 4 K with negative results. Author (NSA)

N70-16052# Princeton Univ., N.J. Plasma Physics Lab.
REACTIVE TRAPPED-ION SOURCE FOR HIGHLY STRIPPED IONS
Thomas H. Stix Sep. 1969 27 p refs
(Cotract AT(30-1)-1238)
(MATT-709) Avail: CFSTI

Considerable current interest is attached to the possibility of producing far-transuranic elements by fusion of heavy nuclei. It has been suggested that the projectile nuclei, brought to a high state of ionization by prestripping in a energetic electron plasma, could be accelerated in conventional accelerators. A new low-dissipation configuration is proposed for the stripping plasma: a thin-slab cloud of energetic electrons is reactively confined in a Phillips Ionization Gauge geometry. Additional anodes help to create an electrostatic potential well that confines the ions during the stripping process. A transverse electric field is used to eject trapped electrons that would otherwise accumulate and neutralize the ion-confining potential maxima. Author (NSA)

N70-16053# Los Alamos Scientific Lab., N. Mex.
CURVES FOR PREDICTING STRESSES IN CONTROLLED FUSION PULSED MAGNETIC FIELD SYSTEMS
D. A. Baker and L. W. Mann 23 May 1969 16 p refs
(Contract W-7405-eng-26)
(LA-4186) Avail: CFSTI

A set of curves is given to aid in the prediction of an elastic system response to the impulsive magnetic forces commonly encountered in controlled fusion research. Results for two magnetic field waveforms are given, an exponentially damped sinusoid, and a sinusoidal rise-to-peak field followed by an exponential decay corresponding to the application of a "crowbar" to sustain the field. Author (NSA)

N70-16057*# California Inst. of Tech., Pasadena.
ELECTRON SCATTERING BY HYDROGEN MOLECULES AT 10 EV WITH EXCITATION OF NUCLEAR MOTION
D. G. Truhlar J. K. Rice, S. Trajmar, and A. Kupperman 1968 12 p refs
(Contract NAS7-100)
(NASA-CR-107687; CONF-690702-3; CALT-767-P4-46) Avail: CFSTI

Calculations were performed on electron scattering by hydrogen molecules in which the static potential (including the long-range quadrupole interaction), the polarization potential, and electron exchange effects were considered simultaneously. The calculations were performed in the Born and Born–Ochkur–Rudge approximations. New experimental differential cross sections (DCS) for elastic and inelastic scattering are also reported. The present calculations agree better with teh experimental elastic DCS than any previous calculations. NSA

N70-16060# California Univ., Los Ageles.
IN SEARCH OF THE ROPER RESONACE IN PION(−) + PROTON YIELDS GAMMA + NEUTRON
B. M. K. Nefkens, P. Berardo, R. P. Haddocr, L. J. Verhey, M. E. Zeller et al 4 Sep. 1969 8 p refs Presented at Intern. Symp. on Electron and Photon Interactions at High Energies, Daresbury, Engl., 14–20 Sep. 1969
(Contract AT(11-1)-34)
(UCLA-34-P-106-42; CONF-690911-1) Avail: CFSTI

A measure is made of the differential cross section for pion(−) + proton yields gamma + neutron interactions at 490 MeV/c. The momentum was selected to determine whether the Roper resonance would be strongly photoproduced on a neutron target. Scintillation counters and spark chambers were used in the study. The results for the differential cross section pion(−) + proton yields gamma + neutron were converted to the gamma + neutron yields pion (−) + proton interaction under the assumption of time reversal invariance. Disagreement with previous results is found. No evidence was found, for the classification of the Roper in an antidecuplet. NSA

N70-16064# International Centre for Theoretical Physics, Trieste (Italy).
SYMMETRICAL DUALITY VERTEX
Henry P. Stapp Sep. 1969 28 p refs Submitted for publication
Sponsored by US AEC
(IC-69-122) Avail: CFSTI

A symmetrical formula for the on-mass-shell three-particle vertex of the generalized Veneziano model is derived. No attempt is made to isolate the contributions corresponding to the different angular momentum components of the three particles. Author (ESRO)

N70-16066# Battis Atomic Power Lab., Pittsburgh, Pa.
AGGLOMERATION OF PARTICLES IN TURBULENT FLOW
S. K. Beal Sep. 1969 21 p refs
(Contract AT-11-1-GEN-14)
(WAPD-TM-904) Avail: CFSTI

Preliminary analysis indicates that agglomeration of particles in turbulent flow is competitive with deposition in its effect on the coolant-borne particle size distribution in the Shippingport Reactor. In a typical situation, the agglomeration rate exceeds the deposition rate for particles smaller than 0.01 micrometer. The reverse is true for particles larger than 10 micrometer, and in the range of 0.1 to 1.0 micrometer the two rates are about equal. Comparison of theory and experiment shows poor agreement regarding the magnitude of the agglomeration rate/deposition rate relationship but good agreement regarding the trend of the relationship with Reynolds number, providing some indication that the theoretical concept is basically correct. Author (NSA)

N70-16070# California Univ., Livermore. Lawrence Radiation Lab.
TRITIUM BREEDING AND ENERGY GENERATION IN LIQUID LITHIUM BLANKETS
J. D. Lee 27 Aug. 1969 22 p Presented at the Intern. Conf. on Nucl. Fusion Reactors. Sponsored by AEC
(UCRL-71757; CONF-690901-3) Avail: CFSTI

Effects of structure volume fraction and Li-6 to Li atom fraction on tritium breeding in a lithium blanket are presented. Tritium and energy generation potential of a number of lithium blanket schemes are compared. Energy generation (fusion plus blanket reactions per gram of natural lithium used) ranged from 8500 to 27,000 kWh. Author (NSA)

N70-16075# Syracuse Univ., N.Y. Dept. of Physics.
CURRENT ALGEBRA AND THE DECAY RATE OF ETA MESON YIELDS 3 PION
Suk Koo Yun and Kunio Yamamoto Aug. 1969 12 p refs Sponsored by AEC
(SU-1206-203) Avail: CFSTI

The decay rate of eta-meson yields 3 pions is calculated in the framework of current algebra with more relaxed limiting procedures than previously done. Instead of the pion-pole approximation, the scalar term is identified with the observed scalar-meson octet, and one particle states of axial vector, scalar and pseudoscalar mesons is used for saturation. Comparison is made with the pion-pole approximation. Author (NSA)

N70-16077# Oak Ridge National Lab., Tenn.
FORM FACTORS FOR INELASTIC SCATTERING: THE CODE ATHENA 4
F. S. Chwieroth, J. I. Dodson, M. B. Johnson, L. W. Owen, and G. R. Satchler 5 Sep. 1969 21 p refs
(ORNL-TM-2703) Avail: CFSTI

A FORTRAN IV code has been written for the IBM 360/75 and 360/91. The code, which is a revised and updated version of the original ATHENA code, computes form factors for inelastic scattering calculations, using single particle wave functions that are eigenstates of motion in either a Woods–Saxon potential well or a harmonic oscillator well. Two body forces of Gauss, Coulomb, Yukawa, and a sum of cut-off Yukawa radial dependences are available; the last may be used, for example, to reproduce the long range part of the Hamada–Johnston potential. A sum of up to 100 wave function components and up to 10 interaction components may be used. The reduced matrix elements of the one body multipole operators may be included automatically in the wave function coefficients. Nonlocal effects on the wave functions may be included in the local energy approximation. Author (NSA)

N70-16086# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
MEASUREMENTS ON 1 GeV ELECTROMAGNETIC CASCADE AND CASCADE-PRODUCED NEUTRONS IN SHIELDING MATERIALS
F. Lucci, M. Pelliccioni, and M. Roccella 15 Apr. 1969 16 p refs *Its* Nota Interna No. 442
(LNF-69/27) Avail: CFSTI

Some properties of electromagnetic showers induced by 600 MeV to 1 GeV bremsstrahlung sigma-rays have been studied in ordinary concrete by thermoluminescent CaF2 dosimeters. The experimental results have been compared with measurements performed elsewhere in several materials. The attenuation of sigma-rays and cascade-produced neutrons in ordinary concrete and in lead and concrete heterogeneous absorbers has been also measured to obtain useful data for problems of shielding. Author

N70-16088# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
THERMAL NEUTRON FLUX PERTURBATIONS IN GOLD CYLINDERS [PERTURBATION DEL FLUJO TERMICO DE NEUTRONES POR CILINDROS DE ORO]
M. Barrachina and R. Radicella 1969 15 p refs In SPANISH; ENGLISH summary
(CNEA-243) Avail: CFSTI

The thermal neutron flux perturbations produced by gold samples have been determined by irradiating two sets of cylinders of equal height (0.6 cm) and different radii (0.025 to 0.2 cm) in the graphite thermal column of the RA 1 reactor. The average specific activity induced at the surface (A sub s) and in the whole volume (A sub v) of the cylinders, referred to an ideal standard sample (A sub o), allowed the determination of the perturbation factors. The experimental values of F were compared with those calculated according to Nisle, Gilat and Gurfinkel, and Gubbins method. In our case, it was found that the total flux perturbation factor F is correctly predicted by the neutron escape probability of the samples, the best fitting estimate obtained by Gubbins equation. Author

N70-16097# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
VARIATIONAL CALCULATION OF THE PROPERTIES OF LIQUID He3-He4 MIXTURES AT 0K
Jean-Pierre Hansen and Daniel Schiff Oct. 1969 11 p refs
(TH-69/63) Avail: CFSTI

The properties of liquid helium 3–helium 4 mixtures at 0 K are studied by a variational method using a Jastrow–Slater trial wave function and the Wu–Feenberg expansion of the energy expectation value: the boson mass 3 - boson mass 4 system shows complete phase separation; the fermion mass 3 - boson mass 4 and the boson mass 3 - fermion mass 4 mixtures separate incompletely; and the fermion mass 3 - fermion mass 4 system mixes completely. The limiting solubility of the mass 3 fermion in the boson mass 4 solvent is found to increase with pressure. Author

N70-16098# Australian National Univ., Canberra. Research School of Physical Sciences.
THE REACTION Na-123(p,p) IN THE RANGE 8.0 TO 12.0 MeV. PART 3: ANALYSIS OF AVERAGE INELASTIC CROSS SECTIONS, FLUCTUATIONS, AND MODEL COMPARISON
J. Hellstroem, P. J. Dallimore, and W. F. Davidson [1969] 34 p refs
(ANU-P/477) Avail: CFSTI

Proton elastic and inelastic cross sections measured in the range 8.0 to 12.0 MeV. The results were analysed using both the combined optical-model, DWBA and Hauser–Feshbach theories and the theory of fluctuations. Predictions of the different models are compared and it is found that intermediate structure is interpreted differently by each model. However, after the effects due to the intermediate structure are taken into account, the agreement between the models is good. Author

N70-16119# Union Carbide Nuclear Co., Oak Ridge, Tenn. Gaseous Diffusion Plant
A NEW NEUTRON DOSIMETER AND NEUTRON-SPECTRUM MODEL FOR NUCLEAR ACCIDENT DOSIMETRY
J. C. Bailey 2 Oct. 1969 76 p refs
(Contract W-7405-eng-26)
(K-1763) Avail: CFSTI

The ORGDP nuclear accident dosimeter utilizes bare and cadmium covered gold for the measurement of thermal neutrons, cadmium covered gold and boron shielded copper for the measurement of resonance neutrons, and sulfur and boron-shielded indium for the measurement of fast neutrons. Interpretation of the measurements is based upon a spectral model comprising a thermal region from 0 to 0.5 eV; a slowing down region from 0.5 eV upward, in which the fluence per unit logarithm of energy is a linear function of log E, but weighted by the fraction of neutrons originating in the fission spectrum at energies higher than E; and

a fast region having the shape of a fission spectrum but with energies which may be shifted from those of the fission spectrum by a constant factor. The dosimetry scheme was tested with 4 different neutron spectra. Comparisons of experimental responses of plutonium, neptunium, and uranium fission were made on the IBM-7090 computer. Author (NSA)

N70-16147# California Univ., Livermore. Lawrence Radiation Lab.

FISSION GAS RELEASE CURVES: GROWTH AND DECAY FROM FISSION OF PU-239 BY FISSION SPECTRUM NEUTRONS

D. C. Barg and W. C. King May 1969 516 p refs
(UCRL-50656; TID-4500; UC-34) Avail: CFSTI

Fission gases from underground nuclear explosions occasionally escape and are vented to the atmosphere. A computer program was used to calculate the amounts of these gases and their daughter products remaining at various times after release. Tables and curves for all fission gas isotopes formed from the fission of Pu-239 by fission spectrum neutrons (from Kr-85 through Kr-94, ad from Xe-133 through Xe-143) are presented, including growth and decay of the daughter products. Decay was computed from .01 min after release to 1 million min after release. Separate tables and curves are presented for the following release times: zero time (prompt release), 1, 5, 10, 30, and 60 min following fissioning. Author (NSA)

N70-16156# Comitato Nazionale Per L'Energia Nucleare, Frascati (Italy). Lab. Nazionali Di Frascati.

FIELD-CURRENT IDENTITY AND HADRONIC CONTRIBUTION TO MUON G-FACTOR

E. Etim (Univ. of Ife, Nigeria) and P. Picchi 16 May 1969 6 p refs *Its* Nota Interna No. 447
(LNF-69/33) Avail: CFSTI

Hadronic contribution to the muon g-factor is calculated according to various mixing schemes using field-current identity techniques. In the measurement of g-2 factor of charged leptons and the measurement of cross sections of genuine electrodynamic processes, the exploration of the limit of validity of QED becomes more difficult when the break-down effects to be observed are comparable to those due to virtual strongly interacting particles. Presently techniques are developed to calculate the hadronic contribution to the muon anomaly, which is very sensitive to the behaviour of QED at small distances. The g-2 experiments can be used to explore the possible existence of an as yet unknown coupling of the muon to another field which might perhaps explain the mass difference between the muon and the electron. Author

N70-16157# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

ELASTIC PROTON-PROTON SCATTERING IN THE EIKONAL MODEL AND THE SLOPE OF THE POMERANCHUK

J. M. Kaplan and D. Schiff [1969] 7 p refs
(TH-69/64) Avail: CFSTI

The minimum modifications to a hybrid model to account for the shrinking of the diffraction peak in p--p scattering at energies greater than 20 GeV/c are investigated. At first the Pomeranchuk trajectory was kept flat, but the required shrinking was not achieved. A slope was then introduced, and the residue of the Pomeranchuk pole as the electromagnetic nucleon form factor squared disappeared. Three new parameters were introduced, and a good semiquantitative fit was obtained for diffraction peak slopes differential cross sections, polarizations, and total cross sections. The behavior of the total cross sections in the model are discussed. N.E.N.

N70-16159# Comitato Nazionale per L'Energia Nucleare, Frascati (Italy). Lab. Nazionali Di Frascati.

NUCLEAR RECOIL CORRECTION AND SHORT RANGE NUCLEON-NUCLEON CORRELATIONS IN ELASTIC ELECTRON SCATTERING FROM LIGHT NUCLEI

A. Malecki (Inst. of Nuclear Physics, Krakow, Poland) and P. Picchi 24 Mar. 1969 18 p refs *Its* Nota Interna No. 439
(LNF-69/19) Avail: CFSTI

A harmonic oscillator well model for large momentum transfer is described which considers the effect of two-body correlations arising from the repulsive core of the nucleon–nucleon interaction. The nuclear center-of-mass motion correction to the elastic form factor in the model with two different oscillator wells was calculated in an exact way. The model was used not only for Li-6, but also for the C-12 and O-16 nuclei in order to obtain a coherent interpretation of the elastic and quase-free electron scattering data. A substantial difference was found between the exact result and the correction usually used. Short-range correlation calculations were performed, and a good fit was obtained to the Li-6 elastic electron scattering data in the model with the two wells. It turns out however that this model (with appreciably different oscillator strengths) is no more successful for C-12 and O-16. Good fits for these nuclei may be obtained using a simpler model with the single oscillator potential well. Author

N70-16172# Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Departamento Fuentes Intensas de Radiacion.

STUDY OF FLUX DISTRIBUTION BY A PLANE IRRADIATOR OF COBALT 60 AND COMPARATIVE YIELD ANALYSIS [ESTUDIO DE LA DISTRIBUCION DE DOSIS PRODUCIDA POR UN IRRADIADOR PLANO DE CO-60 Y ANALISIS COMPARATIVO DE RENDIMIENTO]

Ruben O. Gonzalez 1968 13 p refs In SPANISH
(CNEA-221) Avail: CFSTI

The results of a theoretical study conducted to design an irradiation plant for the generation of atomic energy are presented. The yield variations are analyzed for a rectangular irradiation source for the kinetic radiation of the target, when the thickness and the distance for the source are modified with one or two openings for each side of the source. A method for the theoretical calculation of exposure in air, and a study of flux distribution in air with distance from the source are included. Transl. by F.O.S.

N70-16173# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).

CORRECTING AND REGULATING CYCLOTRON MAGNETIC FIELDS [CORRECCION Y REGULACION DELCAMPO MAGNETICO DEL CICLOTRON]

J. Mayo, M. J. Sametband, J. E. Sinderman, and J. R. Lorenzetti 1969 26 p In SPANISH; ENGLISH summary
(CNEA-238) Avail: CFSTI

The magnetic field in the Buenos Aires Synchrocyclotron was studied with a nuclear resonance fluxmeter, a Hall effect plate and the floating wire technique. Azimuthal inhomogeneities were detected at several radii producing lack of coincidence between the geometric and magnetic median planes up to 1.6 cm and displacement of orbit centers from geometric center up to 2.5 cm. Magnetic field corrections were performed by use of local shimming plates attached to the magnet pole tips. Shim designs for field reducing or field reinforcing corrections were made by use of nomograms which are presented. Field harmonic analyses show that after corrections were done the first harmonic component was reduced by a factor 20 at radii from 65 to 75 cm. The beam radial oscillation at 75 cm radius was consequently reduced by a factor 2. Complete cyclotron data are presented. Field regulation better than 0.01 per cent was obtained by time constant compensations in the original system of the power supply circuit which limited the open loop gain. Author

N70-16181# Atomic Energy of Canada, Ltd., Chalk River, (Ontario). Nuclear Lab.

[NUCLEAR PHYSICS RESEARCH] Progress Report, 1 Jul.–30 Sep. 1969
30 Sep. 1969 81 p refs
(AECL-3512; PR-P-83) Avail: CFSTI

Reports are presented on a variety of investigations in the field of nuclear physics. These include studies on solid state radiation detector, radioactive isotope reactions, properties of excited states, transfer reactions and Coulomb excitation. Research concerning space physics, radioisotope standardization, and beta ray spectroscopy is also included. Neutron physics studies were conducted on phonon dispersion, X-ray thermal diffuse scattering, phase transition, magnonphonon interactions, positron annihilation, gamma ray capture by neutrons, photofission measurements and various spectrometers. Theoretical physics studies are reported for aberrations of a quadrupole lens, a four-sphere model of a quadrupole magnet, heavy ion penetration, neutron scattering, neutron spectrum analysis and nuclear structure of various isotopes. Various computer operations and programs used in the studies are also presented. L.P.H.

N70-16258# Paris Univ. (France). Curie Lab.
ACTINIUM
M. N. Haissinsky *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 60–65 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

The anomalous behavior of actinium, in particular its half-life, is studied and explained by the presence of a short-lived isotope of promethium. Decreased activity of old actinium and actinium prepared by bombarding radium with neutrons yielded half-life periods between 21 to 22 years. Study of promethium isotopes with three pairs of isomers established two beta emitters with half lives of Pm-41 (2.64 years) and Pm-146 (about 1 year). By using the fundamental exponential decay law and assuming a pseudo-exponential decay law for the mixture at differing times, it was possible to calculate the contamination with element 61. The presence of a weak radioactivity, probably alpha decay of Eu-151 with long half-life times, was attributed to the short-lived isotope of promethium. G.G.

N70-16368 Colorado Univ., Boulder.
HYPERON-NUCLEON INTERACTIONS
James Thompson Brown, Jr. (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-4369

A theoretical potential describing the hyperon-nucleon interaction is derived, based on a one-boson-exchange model. Unitary symmetry is used to relate the couplings of the pseudoscalar and vector meson octets and the scalar and vector unitary singlets. The coupling of the Lambda hyperon and Sigma hyperon particle channels has been taken into account. The K matrix for the scattering is determined by numerically integrating the Schroedinger equation. The T=1/2 effective ranges, scattering lengths, and cross sections for the Lambda hyperon and Sigma hyperon interactions are found from the K matrix. The model is relatively insensitive to small changes in the parameters. Within a certain range of values for the coupling constants of the unitary singlets, it may be possible to have a continuum of solutions. A very good fit to the experimental data is obtained with the model. It is also found that the Sigma hyperon channel is quite important for an accurate description of the Lambda hyperon scattering at energies well below the Sigma hyperon threshold. Dissert. Abstr.

N70-16375# Radiation Research Associates, Inc., Fort Worth, Tex.
DIFFERENTIAL MEASUREMENTS OF FAST-NEUTRON AIR-GROUND INTERFACE EFFECTS. PROJECT 9.2: OPERATION HENRE
R. L. French and L. G. Mooney 15 Jul. 1969 37 p refs
(Contract DA-20-113-AMC-06121(T))
(AD-694434; RRA-T-95; ATACOM-TR-10590) Avail: CFSTI
CSCL 18/6

The effect of the air-ground interface on the scattered fast-neutron dose near the ground was measured at a distance of 1000 ft from a 14-MeV neutron source. The source was the HENRE accelerator operated at a height of 112 ft on the BREN tower at the Nevada Test Site. A horizontal slab of polyethylene 1 ft thick and 6 ft square with Hurst-type fast-neutron dosimeters mounted on its upper and lower surfaces, separated the neutrons arriving through the upper 2 pi solid angle from those from the lower 2 pi. A third detector, mounted on a boom, measured the free-field. The entire assembly was suspended by a hoist system to make measurements at 0.75 to 70 ft above the ground. The scattered dose at the top detector was essentially constant, that at the bottom detector increased by a factor of approximately 2 between 0.75 and 70 ft, and the free-field dose increased by less than 25% over the same height range. The experiment provided confirmation, both qualitative and quantitative, of the first-last collision model of the air-ground interface effect. Author (TAB)

N70-16472 Utah State Univ., Logan.
THEORETICAL CALCULATION OF THE CROSS SECTION FOR PAIR PRODUCTION IN A PROTON-PROTON COLLISION
Barry R. Parker (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-1083

The differential cross section for pair production in a proton-proton collision was calculated. Standard perturbation methods with retarded interactions were used throughout the calculation. A total of twelve Feynman diagrams contributed to the process. The results were presented in the form of two graphs. In the first, differential cross section was plotted versus energy of incoming particle. This graph indicated that the cross section near threshold was fairly high but decreased rapidly with increasing energy. In the second graph differential cross section was plotted against angle between pair. This graph indicated that the cross section increases with decreasing angle between the pairs. Dissert. Abstr.

N70-16501# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.
PROCEEDINGS OF THE 1968 PROTON LINEAR ACCELERATOR CONFERENCE, PART 1
May 1968 442 p refs Held at Upton, New York, 20–24 May 1968 Sponsored by AEC Prepared in cooperation with Assoc. Univ., Inc.
(BNL-50120(C-54)-Pt-1) Avail: CFSTI

The conference papers presented on proton linacs pertain to mechanical design, RF sources, automatic control systems, ion sources, and beam dynamics. For individual titles, see N70-16502 through N70-16547.

N70-16505# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).
ACCELERATOR MAGNET DEVELOPMENT AT CRNL
A. Harvey, W. A. Wolfe, F. B. Bleckstein, and A. J. Otter *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 41–51 refs (See N70-16501 05-24)
Avail: CFSTI

Two unique requirements for the magnets of the intense neutron generator are discussed. These are that they must be of high quality, to spill as small a fraction of the proton beam current and that they must be able to withstand a higher radiation dose from the particles which are spilled. The magnet requirements for the Alvarez section and coupled cavity section are also discussed. NSA

N70-16506# California Univ., Berkeley. Lawrence Radiation Lab.
HIGH GRADIENT MAGNETIC DRIFT TUBE QUADRUPOLES
Robert N. Main, Klaus Halbach, Patrick Kennedy, Roland Yourd,

Albert Watanabe et al *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 52–59 refs (See N70-16501 05-24)
Avail: CFSTI

The high-gradient magnetic drift tube quadrupoles for the Berkley heavy-ion accelerator (Hilac) are discussed. Topics include tape coils, coil fabrication, yoke-pole design, yoke-pole fabrication, drift-tube design, and magnet performance. NSA

N70-16507# Kansas State Univ., Manhattan.
A NEW TECHNIQUE FOR HIGH PRECISION ALIGNMENT OF LINEAR ACCELERATORS
Hans D. Betz *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 60–67 refs (See N70-16501 05-24)
Avail: CFSTI

A new alignment and surveillance technique of high accuracy is described. Utilizing asymmetrical effects produced in the light distribution of a laser beam, this new method shows remarkable advantages: any number of object-points can be placed on a straight line and displacements of 0.01 mm, for example, are detectable in distances from zero to several kilometers, provided that the disturbing influences of turbulence and refraction in the atmosphere are eliminated. The setup is very simple, and all targets representing object-points are identical. Therefore, the equipment to be used, including the detection unit, is independent of all distances involved. The alignment can be done simultaneously in two dimensions, both visually and fully automated. Special applications to linear accelerators with lengths up to several kilometers will be discussed and compared with conventional and existing alignment techniques. Limitations and distorting effects will also be considered. Author (NSA)

N70-16508# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).
RF SOURCES DEVELOPMENT AT CRNL
P. J. Waterton *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 68–75 refs (See N70-16501 05-24)
Avail: CFSTI

The size and efficiency requirements of the RF sources for the ING linear accelerator are discussed. NSA

N70-16509# Los Alamos Scientific Lab., N.Mex.
THE 806 MHz POWER SOURCES FOR THE LAMPF ACCELERATOR
D. C. Hagerman *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 76–86 refs (See N70-16501 05-24)
Avail: CFSTI

Interaction problems of high power RF sources and high Q resonant loads were resolved. The RF systems for standing wave accelerator applications were compared along with cost studies of klystron, triodes, and CFA systems. A 1.25 MW peak power klystron was used to verify that a klystron is suitable for powering a proton linac. An electron prototype accelerator with similar beam loading effects to the proton linac was studied to optimize control system performance under realistic operating conditions. The test stand design is being improved to a degree suitable for production of 44 amplifiers. J.A.M.

N70-16514# Brookhaven National Lab., Upton, N.Y.
TRANSIENT BEAM LOADING IN STANDING WAVE LINACS
M. J. Lee *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 108–113 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

Steady-state cavity excitation and beam loading in standing wave linacs have been analyzed by a number of authors. More recently, analysis included transient behavior of these phenomena. In all of the analyses to date, constant beam velocity and identical cavity cells are assumed. These assumptions, however, become less valid for low energy linac cavities such as those at the beginning of the Conversion linac. In the present paper the amplitude of the beam induced field is calculated. The analysis takes into account the changes in the beam velocity and cavity cell length along the linac. Author (NSA)

N70-16515# Brookhaven National Lab., Upton, N.Y.
STEADY STATE BEAM LOADING OF A STANDING WAVE RF SYSTEM
M. J. Lee *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 114–122 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

Two criteria which take into account the effects of steady state loading were considered theoretically for the linac RF system design. In one, the power transferred to the linac cavity was maximized for maximum beam current. In the other, the system was designed so that phase compensation for beam loading was not required. Zero phase compensation was shown always obtainable provided that the load susceptance was adjustable. Author

N70-16524# Argonne National Lab., Ill.
BEAM DIAGNOSTICS OF THE 50 MeV PROTON LINEAR ACCELERATOR OF THE ARGONNE ZERO GRADIENT SYNCHROTRON
M. E. Abdelaziz and R. Perry *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 198–219 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

Since the performance and stability of the Zero Gradient Synchrotron (ZGS) are critically dependent on the linac beam behavior, it is necessary to study the properties of the 50-MeV proton linac beam for the ultimate purpose of its control by the CDC 924 computer. The first property examined was beam position monitoring. This included analysis of calculations of induced loop voltage, experimental characteristics of loop position detectors and effects of linac parameters on beam position. The second property was beam emittance and a method for performing these measurements is described. NSA

N70-16525# Argonne National Lab., Ill.
PHASE SHIFT OF BEAM BUNCHES AS A FUNCTION OF LINAC ACCELERATING GRADIENT
Rolland Perry and Joseph Abraham *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 220–227 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

It was shown in an earlier report that an unexpectedly large phase shift occurs in beam bunches from the ANL 50 MeV, 200 MHz linac when the RF gradient is allowed to fall due to beam loading, and that this phase shift does not occur when the gradient is held constant. No corresponding shift of phase of the RF fields in the linac cavity were observed; and, since there was a reduction of beam current accompanying the phase shift and the gradient reduction, it was not made clear by deliberately reducing the current whether the current or the RF gradient is the independent variable since the two were interdependent. There was also some question regarding the possibility of phase shift of the RF field on axis relative to the field at the cavity wall. Further measurements were made in an attempt to resolve some of these questions. Author (NSA)

N70-16526# Brookhaven National Lab., Upton, N.Y.
RECENT PROGRESS IN LINAC PRE-ACCELERATORS
Th. J. M. Sluyters *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 228–239 refs Sponsored

by AEC (See N70-16501 05-24)
Avail: CFSTI

Ion source development is considered, such as the control of current and uniformity of the plasma emitter in the expansion chamber of the duoplasmatron, and a possible relation between expansion cup geometries and apparent source emittances. Results are summarized on low and high gradient acceleration without significant apparent dilution up to 750 kV with and without prefocusing. Ideas for the transport region between accelerator and linac are discussed. Author

N70-16527# Commissariat a L'Energie Atomique, Saclay (France).
THE NEW SATURNE INJECTOR STATUS REPORT ON THE 750 keV PREINJECTOR
J. Faure *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 240–250 refs (See N70-16501 05-24)
Avail: CFSTI

A report on the new 20-MeV linac 750 keV preinjector named Amalthee is presented. This preinjector provides a 100 aM proton pulsed beam at the linac entrance. The pulse duration is 200 micro sec and the beam emittance value at the output of the preinjector itself is, so far, 2.5 × .000001 m-rad (normalized value). First, the preinjector is described. Then the results of emittance measurements are given and discussed. Finally, the ion optics between Amalthee and linac are examined. Author (NSA)

N70-16529# European Organization for Nuclear Research, Geneva (Switzerland).
PRELIMINARY STUDY OF A HIGHER ENERGY PRE-INJECTOR FOR THE CERN PS
J. Huguenin, U. Tallgren, and M. Weiss *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 269–292 refs (See N70-16501 05-24)
Avail: CFSTI

The improvement program of the CERN PS linac foresees a possible reconstruction of the first tank. In connection with this we felt it interesting to study the influence of an increase in the preinjector energy. The results from a first study presented here indicate interesting advantages to be gained, particularly if the preinjector energy could be pushed up drastically, e.g., by a factor 4–5. Technological aspects will put a limit to such a change and a fresh look at the problem connected with the accelerating tube, H.T. supply and the ion source has been made. Lay-out, reliability and operational aspects were also discussed. It was concluded that it would be worth while to carry out a more detailed study of the feasibility of a higher energy pre-injector in view of the potential advantages to be gained for the linac beam. Author (NSA)

N70-16530# Los Alamos Scientific Lab., N.Mex.
THE LASL HIGH-DUTY-FACTOR ION SOURCE
C. R. Emigh and Donald W.Mueller *In* Brookhaven Natl. Lab Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 293–305 refs (See N70-16501 05-24)
Avail: CFSTI

The ion source, a conventional duoplasmatron, was given special attention in the high intensity injector design to provide high-velocity cooling water to the intermediate electrode and to the system containing the anode plasma aperture. Characteristic features of the extracted ion current pulse and associated arc current and voltage are illustrated. The nature of the noise and oscillations on the ion beam current was examined using fast oscilloscope speeds. From visual observations of beam size and intensity at the extractor aperture, as a function of very short pulse lengths, the time history of plasma formation in the ion source can be inferred. Results of life tests on a prototype ion source operated at the required 6 percent duty factor (DF) are given, indicating satisfactory compliance with basic requirements. Some preliminary results of 12 percent DF operation are also presented. J.A.M.

N70-16531# Argonne National Lab., Ill.
A COMPARATIVE STUDY OF DRIFTING ARC AND EXTENDED STATIONARY ARC DUOPLASMATRONS
John A. Fasolo *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 306–316 (See N70-16501 05-24)
Avail: CFSTI

A drifting arc duoplasmatron used in previous studies has been converted into an extended stationary arc duoplasmatron for use in a comparative study of these two basically different source types. To facilitate comparison, the Pierce extraction geometry of the drifting arc source has been retained. Some results of this study will be presented and discussed. Author (NSA)

N70-16532# European Organization for Nuclear Research, Geneva (Switzerland).
BUNCHING
P. M. Lapostolle *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 317–327 refs (See N70-16501 05-24)
Avail: CFSTI

After having reviewed the various performances which can be attributed to a buncher and some of the devices which have been used so far or studied in the absence of space charge, the problem of bunching at high intensity is considered and various types of attempts are described with some numerical results given. Author (NSA)

N70-16533# Brookhaven National Lab., Upton, N.Y.
DESIGN OF A BUNCHER AND THE TRANSPORT SYSTEM IN ITS DRIFT SPACE FOR THE 200 MeV BNL INJECTOR LINAC
C. Agritellis and R. Chasman *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 328–337 Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

Space charge effect on the bunching process was examined. A buncher design was found for optimal performance with regard to bunching efficiency and transverse beam matching throughout a beam current range of 50 to 400 mA, as well as for the ability to produce a tight bunch at low current to facilitate the linac calibration procedure. The single buncher efficiency was studied as a function of buncher voltage for five beam currents of 50, 100, 200, 300, and 400 mA, and for various bunch linac drift distances. To increase bunching efficiency, numerical calculations were performed for double buncher varying parameters, such as distance, voltage, and frequency. For 50 mA several double buncher designs were found which can bunch the beam into a phase spread of + or – 20 deg with an efficiency of 60 percent. Magnetic field gradients in the quadrupoles varied from 0.8 to 1.8 kG/cm for corresponding beam currents between 50 and 400 mA. Computer programs were written and compared for two- and six-dimensional particle motion codes. J.A.M.

N70-16534# Los Alamos Scientific Lab., N.Mex.
DOUBLE-DRIFT BUNCHER
C. Robert Emigh *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 338–345 refs Sponsored by AEC (See N70-16501 05-24)
Avail: CFSTI

Particle velocity through different drift distances was calculated along with the particle phase density and arrival time at the linac. Atomistic methods, that treat the beam as a small element population, were used to analyze the double drift buncher action with space charge effects. These effects are compared with the maximum particle percentage that can be bunched within a phase and for a cavity voltage of 20 kV, using a double-drift buncher, a single-cavity buncher, and a two-gap harmonic buncher. J.A.M.

N70-16535# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).

LONGITUDINAL SPACE-CHARGE EFFECTS IN BUNCHERS

G. E. Lee-Whiting and J. H. Ormrod *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 346-352 (See N70-16501 05-24)

Avail: CFSTI

Calculators of space-charge effects in the early stages of proton linacs have usually made some arbitrary assumption about the distribution of charge density in the bunch. It ought to be possible to make an estimate of the charge density by following the motion of the protons from the injector through the buncher to the accelrator entrance. Two differerent attempts to perform such a calculation are described. NSA

N70-16536# Rennes Univ. (France).

PHASE SPACE ACCEPTANCE OF A QUADRUPOLE DOUBLET ANALYTIC EXPRESSIONS AND NUMERICAL RESULTS

E. Regenstreif *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 353-356 (See N70-16501 05-24)

Avail: CFSTI

The phase space acceptance of a quadrupole doublet in the focusing plane and in the defocusing plane was calculated. NSA

N70-16537# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).

ACCEPTANCE CALCULATIONS FOR ACCELERATOR BEAM LINES

F. P. Blackstein *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 357-363 refs (See N70-16501 05-24)

Avail: CFSTI

A computer program to determine the first order phase plane acceptance of accelerator beam lines is described. It is based on an iterative technique for scanning the phase space and computing time is reduced by na order of magnitude when compared to similar methods employing an ordered scan in rectangular coordinates. An exmaple system is analyzed; acceptance polygons are presented and the energy dependence of the beam line acceptance is computed. Author (NSA)

N70-16538# Los Alamos Scientific Lab., N.Mex.

THE BEAM TRANSPORT DESIGN FOR THE LAMPF INJECTOR

Paul W. Allison and Ralph R. Stevens, Jr. *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 364-371 refs (See N70-16501 05-24)

Avail: CFSTI

Injector area for LAMPF was designed to handle three ion sources (two high intensity 50 mA source and a polarized ion source). Beam transport features were determined from Kapchinskij-Validimirskij equations for beam dynamics with space charge, emittance, and linear lenses and from studies of the aberrations induced by beam transport magnets. Problems of phase space matching and beam polarization were also considered.

Author

N70-16539# Brookhaven National Lab., Upton, N.Y.

NUMERICAL CALCULATIONS OF THE EFFECTS OF SPACE CHARGE ON SIX DIMENSIONAL BEAM DYNAMICS IN PROTON LINEAR ACCELERATORS

R. Chasman *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 372-388 refs Sponsored by AEC (See N70-16501 05-24)

Avail: CFSTI

Six dimensional linac orbits were calculated with a computer program which was designed to include space charge forces in a perfect linac. A simple reliable prescription was found to match the beam to the longitudinal and transverse admittances of the linac. The resultant beam envelope oscillations remain quite small during the acceleration. Matched beams with currents up to several hundred milliemperes can be accelerated through the linac using measured characteristics of recently developed preinjectors and high initial quadrupole gradient. A transverse emittance growth in beams with a brightness of 10 to the 9th power and higher was caused by nonlinear space charge forces. Author

N70-16540# Massachusetts Univ., Amherst.

MULTIMODE AND RESONANCE EFFECTS IN TRANSVERSE BEAM BLOW-UP

R. L. Gluckstern and S. C. Prasad *In* Brookhaven Natl. Lab., Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 389-394 refs (See N70-16501 05-24)

Avail: CFSTI

The usual estimate of the current at which transverse beam blow-up occurs is made under the assumption of a single transverse mode not in resonance with the beam frequency. For a single mode the starting current decreases by less than a factor of two at resonance. The case of seveveral modes was numerically treated, using an eigen-mode method and considerable structure was found in the dependence of the starting current on the frequency of the transverse band. Specifically reductions were found of up to a factor two as the frequencies of the main mode and the adjacent mode pass through resonance with the beam frequency. Furthermore, there are additional variations exactly midway between these resonances. Typical numerical results of this eigen-mode method are presented. In addition, the particular features of each anomaly are derived from an analysis of which modes are most important at each frequency. Author (NSA)

N70-16541# Tokyo Univ. (Japan). Dept. of Physics and Institute for Nuclear Study.

A UNIFIED THEORY ON BEAM DYNAMICS IN PROTON LINACS

T. Nishikawa *In* Brookhaven Natl. Lab., Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 395-399 refs (See N70-16501 05-24)

Avail: CFSTI

Using the Vlasov equation, the longitudinal and the transverse motions in proton linacs in a six-dimensional phase space were discussed. Although some simplified assumptions were made, a unified theory is derived for the physical analysis on space-charge effects, longitudinal and transverse coupling effects, and other high intensity effects. In particular, it is pointed out that the coupling between the longitudinal and the transverse motions will be considerably enhanced through the collective motion of the particle assembly. Author (NSA)

N70-16542# Tokyo Univ. (Japan). Dept. of Physics.

ELECTROMAGNETIC FIELD OF TRAVELING CHARGE IN BEAM DUCT

Hiromasa Hirakawa *In* Brookhaven Natl. Lab., Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 400-408 refs (See N70-16501 05-24)

Avail: CFSTI

The space charge field in a beam duct is expanded in a power series of a paremeter alpha which is proportional to the square root of wall resistivity. The leading term in the expansion is the field in a duct of perfect conductor. The self-defocusing force of the space charge is modified by the induced charge on the wall. Generally, the induced charge gives a longitudinal focusing force, while it invariably is accompanied by transverse defocusing forces (Earnshaw's theorem). Besides these, the whole space charge is attracted toward the wall when the charge distribution has no

symmetry around the axis. This contributes to the orbit distortion and the instability of the orbit with respect to transverse displacements. The second term in the expansion gives a decelerating force for the charge, which makes up for the energy dissipation in the duct wall, together with transverse forces, which are responsible for resistive instabilities. In the following, the field of traveling charge in a cylindrical duct of perfect conductor is examined. Author (NSA)

N70-16543# European Organization for Nuclear Research, Geneva (Switzerland).

LONGITUDINAL AND TRANSVERSE T AND S TRANSIT TIME COEFFICIENTS

B. Schnizer *In* Brookhaven Natl. Lab., Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 409-415 refs (See N70-16501 04-24)

Avail: CFSTI

Difference equations describing the motion of a proton through an accelerating gap have been given by Lapostolle at the Frascati Conference (1965) and by the author (Washington Conference, 1967). The dynamical coefficients contained in them are discussed. There are two types, called T- and S- coefficients. T-coefficients belong to motion across the whole gap and have a simple form (transit time factor times a modified Bessel function). Difference equations through the first half of the gap needed to determine the mid-gap values of the particle coordinates, involve in additionS-coefficients. Exact expressions (series expansions) for the latter are given here assuming that the Fourier coefficients, and the longitudinal field along the gap circumference, are known. Approximations for the S-coefficients are discussed. Corrected Tables of nonrelativistic and relativistic difference equations are given. Author (NSA)

N70-16544# Brookhaven National Lab., Upton, N.Y.

REDUCTION OF ENERGY SPREAD ON THE RUTHERFORD LABORATORY P.L.A.

A. Carne (Rutherford High Energy Lab.), J. M. Dickson (Rutherford High Energy Lab.), S. Norcliffe (Rutherford High Energy Lab.), J. S. Webb, and K. Batchelor *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part1 May 1968 p 416-425 refs (See N70-16501 05-24)

Avail: CFSTI

Two methods for reducing the energy spread on the Rutherford Laboratory proton linear accelerator are discussed. The first consists of shaping the fields along the linac to control the energy acceptance along the machine. The second consists of using a debuncher. NSA

N70-16545# Argonne National Lab., Ill.

ENERGY MODULATED BEAM INJECTION AT THE ARGONNE ZERO GRADIENT SYNCHROTRON

W. Myers *In* Brookhaven Natl. Lab., Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 426-429 ref Sponsored by AEC (See N70-16501 05-24)

Avail: CFSTI

The methods used and the results obtained from Zero Gradient Synchrotron machine studies in which the energy modulation technique was applied to both fast and slow ring RF turn-on programs are discussed. Author (NSA)

N70-16546# Yale Univ., New Haven, Conn.

CALCULATION OF THE DEPOLARIZATION OF AN INITIALLY POLARIZED BEAM IN THE LOS ALAMOS LINAC

Richard M. Mobley *In* Brookhaven Natl. Lab., Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 430-432 refs (See N70-16501 05-24)

(Contract AT-(30-1)-2726)

Avail: CFSTI

A polarized proton beam is planned for the Los Alamos Meson Facility. A numerical calculation of the spin motion for a sufficient number of orbits was performed to obtain a reliable evaluation of the amount of depolarization to be expected in the linac. A major advantage of linacs in the field of polarized beams is the ability to propagate the beam with any orientation of the polarization vector. Thus it is possible to provide a longitudinally polarized beam at a target area off the main beam line by tilting the polarization vector at injection to compensate for the change in orientation occurring at the bending magnet. For this reason skewed orientations were used as well as transverse and longitudinal orientations in the calculations. Author (NSA)

N70-16547# Brookhaven National Lab., Upton, N.Y.

ROUND TABLE DISCUSSION ON SPACE CHARGE AND RELATED EFFECTS

L. Smith (National Accelerator Lab.), R. W. Chasman, K. R. Crandall (Los Alamos Scientific Lab.), R. L. Gluckstern (Univ. of Massachusetts), T. Nishikawa (Univ. of Tokyo) et al *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 433-444 refs (See N70-16501 05-24)

Avail: CFSTI

Theoretical work on phenomena which determined emittance and energy spread of linac beams is discussed with emphasis on space charge effects. Author

N70-16548# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.

PROCEEDINGS OF THE 1968 PROTON LINEAR ACCELERATOR CONFERENCE, PART 2

May 1968 368 p refs Held at Upton, New York, 20-24 May 1968 Sponsored by AEC Prepared in cooperation with Assoc. Univ., Inc.

(BNL-50120(C-54)-PT-2) Avail: CFSTI

The conference papers on proton linacs pertain to RF structures, progress reports on existing accelerators, plans for new accelerators, and electron, heavy ion, and cryogenic accelerators. For individual titles, see N70-16549 through N70-16581.

N70-16549# European Organization for Nuclear Research, Geneva (Switzerland).

A NEW INTERPRETATION OF STRUCTURE COMPENSATION

G. Dome and P. Lapostolle *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 445-456 refs (See N70-16548 05-24)

Avail: CFSTI

In a periodic structure, there are two basic waves for each frequency. Inside a passband, these basic waves are the two traveling waves which can propagate in both directions down the structure. At the edge of a passband (0 or pion mode), the two traveling waves become identical, and another basic solution must be found. This second solution, instead of being periodic, varies linearly along the structure. The basic waves have opposite parities with respect to a symmetry plane of the structure. If the adjacent edges of two neighboring passbands are considered, the two periodic waves at these two cut-off frequencies have also different parities. When the structure is progressively deformed until the two adjacent cutoff frequencies merge, that is when the structure is being compensated, the nonperiodic wave at one frequency tends towards the periodic wave at the other frequency. Author (NSA)

N70-16550# Brookhaven National Lab., Upton, N.Y.

TRIPERIODIC STRUCTURE

B. Epsztein and Tran Duc Tien *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 457-470 refs Sponsored in part by Dept. de Physique Nucleaire, Inst. de Recherches (See N70-16548 05-24)

Avail: CFSTI

A number of alternating periodic structures have been described which operate with a pi 2 phase shift between adjacent cavities, simulating a pi mode configuration while alternate cavities remain

empty. It is shown that similar properties can be obtained with a structure operating with a 2 pi/3 phase shift. The basic cell, made of three cavities, is one wavelength long. If correct terminating conditions are satisfied, a standing wave pattern can be set up which simulates the pi mode field in two cavities, the third being empty. In an iris structure the empty cavities have a reduced length with respect to the others. Calculations and measurements show that the impedance is improved with respect to the corresponding pi/2 structure, due to the fact that there is only one empty cell per wavelength instead of two, while other electrical properties remain unchanged. A drift tube structure is also investigated. The coupling cavities are so designed as to prevent their direct excitation by the beam. Author (NSA)

N70-16551# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).

ANALYSIS OF EQUIVALENT CIRCUITS FOR LINAC TANKS

G. E. Lee Whiting *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 471–474 ref (See N70-16548 05-24)

Avail: CFSTI

Two chains of N inductance–capicitance–resistance loops having inductive coupling (with coupling constant k) between nearest neighbors are described. Chain A is terminated with half loops, chain B with full loops. The resonant frequency, and the quality factor are the same for all loops in both chains. Such chains are useful in studying the response and the sensitivity to error of tanks of nagnetically coupled cavities of the type that might be used in an 805 Mhz standingwave proton linac. Work has shown that for many of its properties a linac tank may be represented by an equivalent circuit of the type shown. An analysis is presented of the steady-state response of both chains to a driving EMF, shown in the pth loop in the fiture. The useful insensitivity of the loop currents to parameter error in the pi 2 mode is shown to extend to the second order of perturbation theory. NSA

N70-16552# European Organization for Nuclear Research, Geneva (Switzerland).

MEASUREMENTS OF FIELD STABILITY AGAINST PERTURBATIONS IN NON-UNIFORM LINAC STRUCTURES

G. Dome and I. White *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 475–498 refs (See N70-16548 05-24)

Avail: CFSTI

Scale models of tank 1 (0.75–5 MeV) and tank 2 (10–30 MeV) have been used to investigate the stability of the axial electric field against individual cell tuning errors. The axial electric field is shown to be unaffected by a perturbation produced by a metallic rod parallel to the axis and placed at one end of the tank. Insensitivity of the field to perturbations has also been achieved experimentally with two stems at 150 deg on each drift tube, all stems being parallel from one drift tube to the next. The frequency shift of the Alvarez zero-mode due to the stems is larger than predicted by theory in tank 1. A compensated structure for tank 2 is the cross-bar with an appropriate stem diameter. When the stem diameter is kept constant throughout the tank, compensation is achieved only on the average and the axial field is strongly effected in the region where the perturbation is introduced. Author (NSA)

N70-16553# Los Alamos Scientific Lab., N.Mex.

FIELD PERTURBATIONS IN THE POST COUPLED DRIFT TUBE LINAC

E. J. Schneider and D. A. Swenson *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 499–511 refs Sponsored by AEC (See N70-16548 05-24)

Avail: CFSTI

Post coupler excitations have been shown to depend on tuning errors and power losses as predicted by the coupled resonator analysis. It was necessary to resort to very large tuning errors in order to produce measurable transverse fields on the axis of the linac. Tuning errors in an actual linac will certainly be 100 to 1000 times smaller than the tuning errors used here. The largest transverse field measured here when reduced by a factor of 100, would produce a transverse impulse that is very small compared to the radial impulse received by the average particle on crossing the gap. The quadrupole focusing system can easily counteract transverse fields of these magnitudes. Author (NSA)

N70-16554# European Organization for Nuclear Research, Geneva (Switzerland).

AN IMPROVED METHOD FOR CALCULATING PROTON LINAC CAVITIES

M. Martini and D. J. Warner *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 512–522 refs (See N70-16548 05-24)

Avail: CFSTI

An improved method for calculating the electromagnetic fields in a linac cavity of Alvarez type is presented. The solution of a finite difference form of the wave equation is obtained by the combined use of analytical formulae and the point succesive overrelaxation technique. By limiting the application of the numerical approach to the axial region of the linac cell where the complicated shape of boundary renders it unavoidable and in using analytical expansions elsewhere, an improved precision is obtained in a relatively short computer time. This precision is tested by comparison of the results obtained with those of other authors and by computing for each case a normalization factor which proves to be a sensitive check parameter. A Fortran program, CLAS (CERN Linear Accelerator Structures), capable of treating cavities with rotational symmetry and a general drift-tube profile, is described. Author (NSA)

N70-16555# Brookhaven National Lab., Upton, N.Y.

OPTIMIZATION OF ALTERNATING - PERIODIC IRIS-LOADED DEFLECTORS FOR SUPERCONDUCTING RF BEAM SEPARATORS

H. Hahn *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 523–532 refs Sponsored by AEC (See N70-16548 05-24)

Avail: CFSTI

Analytical expressions for transverse shunt impedance, peak fields, group velocity, etc. of alternating-periodic iris-loaded deflector cavities operating in the confluent pi 2 mode are derived from the TM11-like small pitch approximation. It is shown that the smallest peak fields and the largest shunt impedance are obtained in structures with vanishingly small width of the coupling cell. An optimization of the structure determines the ratio of the beam hole radius divided by the wavelength to be 0.3, implying a forward wave operation. Possible complications due to the degenerate dispersion diagram are discussed. Author

N70-16556# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).

LINAC CAVITY FIELD CALCULATIONS

G. E. Lee-Whiting *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 533–536 refs (See N70-16548 05-24)

Avail: CFSTI

Calculations of fields in linac cells indicated that difficulties arose with Alvarez-type cells, especially at lower values of beta. Convergence becomes slower as beta is decreased, and there is some doubt about the accuracy of the results. Three devices for improving the calculation are discussed. They are directed toward decreasing the number of mesh points, improving the starting values for the relaxation, and increasing the speed of convergence of the frequency-iteration. Author (NSA)

N70-16557# Brookhaven National Lab., Upton, N.Y.
A MESH ITERATION PROGRAM FOR CALCULATIONS IN LINAC CAVITIES
G. Parzen *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 537–542 refs Sponsored by AEC (See N70-16548 05-24)
Avail: CFSTI

The mesh-iteration program treats the problem of the single cell whose end boundary conditions require the fields to be periodic with the period of the cell length. A differential equation is derived for solving the lowest mode of the cell in terms of the azimuthal component of the magnetic field. Equations are also derived for calculating the electric field from the function F, which is used in solving the equation for the lowest mode of the cell. A variational principle is given for more accurate solution of the resonant frequency. The given problems for the electric fields and resonant frequency of the lowest mode can be solved by various mesh-iteration programs. R.B.

N70-16558# Tokyo Univ. (Japan).
MODEL CAVITY STUDIES FOR TANK DESIGN AND ON TANK FABRICATION
S. Okumura, J. Tanaka, and Y. Tao *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf. Part 2 May 1968 p. 543–556 refs (See N70-16548 05-24)
Avail: CFSTI

The design and fabrication of the first tank of the accelerating structure of an injector linac, in which protons are accelerated from 0.75 to 10 MeV, are discussed. The design study was based on data from MURA linac cavity calculations. NSA

N70-16559# Kernforschungszentrum, Karlsruhe (West Germany).
STUDIES OF A SLOTTED IRIS STRUCTURE: DISPERSION CURVE, COUPLING, FLATNESS, AND ELECTRON ANALOG EXPERIMENT
H. Eschelbacher, M. Kuntze, D. Schinzel, and J. Vetter *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 557–564 refs (See N70-16548 05-24)
Avail: CFSTI

The results of studies on bi-periodic slotted-ins structures for superconducting linear accelerators are presented. The main goal of the studies was to arrive at simultaneously high shunt impedance and high group velocity for a structure that can be plated with a superconducting layer. NSA

N70-16561# Brookhaven National Lab., Upton, N.Y.
A PRELIMINARY STUDY OF THE TS ZERO MODE AND ITS ROLE IN FIELD FLATTENING OF MULTI AND TUNABLE STEM ACCELERATING STRUCTURES
S. Giordano and J. Hannwacker *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 570–578 refs Sponsored by AEC (See N70-16548 05-24)
Avail: CFSTI

Two new structures, the side coupled and alternating periodic, for accelerating modes are compared to the slotted iris and cloverleaf structures. The new mode structures use a high shunt impedance, which vastly improves the reduction of amplitude and phase variations. Tank field measurements show that the effects of a perturbation can be compensated by employing either a multistem or alternating stem structure. When a perturber is introduced into the linac cavity, the TM 010 mode is tilted and the TS 100 mode is excited simultaneously. Thus, the fields of the TS 100 mode will exactly compensate for the change in the fields of the perturbed TM 010 mode when the proper stem parameters are chosen. R.B.

N70-16562# San Jose State Coll., Calif.
FIELD STABILIZATION IN PERIODIC SYSTEMS
D. Carter *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 579–582 refs Sponsored by AEC (See N70-16548 05-24)
Avail: CFSTI

Stabilization of periodic fields has been described together with a measure of such stabilization. Dispersion relationships and fields have been expessed for stabilized cavities. Author (NSA)

N70-16563# Brookhaven National Lab., Upton, N.Y.
ROUND TABLE DISCUSSION OF RF STRUCTURES
E. A. Knapp (Los Alamos Scientific Lab.), A. Carne (Rutherford High Energy Lab.), G. Dome (European Organization for Nuclear Research), S. T. Giordano (Brookhaven National Lab.), C. W. Owen et al ((National Accelerator Lab.), D. A. Swenson (Los Alamos Scientific Lab.) *In its* Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 583–599 refs (See N70-16548 05-24)
Avail: CFSTI

Measurements made at different nuclear research laboratories on RF structures are described. The various structures include loop-coupled pill box, crossbar, side-coupled, alternating-periodic, multistem, and post-coupled structures which operate on different mechanisms. Techniques and configurations are discussed for reducing losses in the linac cavities. Illustrations are given for dispersion curves, axial peak field, and resonant frequency for tank 1 and tank 2 models. R.B.

N70-16564# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).
FUTURE FACTORY TYPE ACCELERATORS
W. Bennett Lewis *In its* Brookhaven Natl. Lab. Proc of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 600–605 (See N70-16548 05-24)
Avail: CFSTI

The design characteristics of various types of accelerators for use in accelerator-assisted thermal neutron reactor system for economic production of neutrons are examined. NSA

N70-16565# California Univ., Berkeley. Lawrence Radiation Lab.
THE ELECTRON RING ACCELERATOR
Andrew M. Sessler *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 606–607 (See N70-16548 05-24)
Avail: CFSTI

The principles of the electron ring accelerator will be presented, along with characteristic parameters. The present status of understanding will be reviewed, with attention to the diverse phenomenon which control and circumscribe the accelerator performance. The Lawrence Radiation Laboratory model program will be described. Author

N70-16566# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).
STATUS OF THE INTENSE NEUTRON GENERATOR STUDY PROGRAMME
P. R. Tunnicliffe and A. G. Ward *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 608–621 refs (See N70-16548 05-24)
Avail: CFSTI

The status of AECL studies of the Intense Neutron Generator are summarized. ING is primarily a research instrument for the production of neutrons and mesons and is intended as the focal point of a many-sided research institute. A thermal neutron flux of 10 to the 16th n/sq cm sec at the inner end of several beam tubes, high flux irradiation facilities, a saleable output of neutron produced isotopes, and a meson factory are highlights of this project. The primary neutron source, would be generated by bombarding a lead-bismuth target with a continuous 65 mA beam of 1 GeV protons. Author (NSA)

N70-16567# Los Alamos Scientific Lab., N.Mex.
LINEAR ACCELERATOR FOR UNSTABLE PARTICLES
D. E. Nagle *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 622–623 refs (See N70-16548 05-24)
Avail: CFSTI

New techniques such as superconducting cavities are discussed for producing economically larger accelerating electric fields and reducing the loss from beta decay. Parameters are given for a linac designed to accelerate pions from an external pion beam of a meson factory. By using a superconducting cavity, RF installation costs are reduced to a minimum and refrigeration requirements are reasonable. R.B.

N70-16571# Stanford Univ., Calif.
RECENT DEVELOPMENTS AT SLAC
R. H. Helm, G. A. Loew, R. H. Miller, and R. B. Neal *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 673–693 refs (See N70-16548 05-24)
Avail: CFSTI

Operating results of the two-mile accelerator at SLAC are summarized and various improvement programs now underway or projected are described. Statistics are given for the number of operating shifts per week devoted to particle physics versus the shifts used for machine physics. A breakdown is illustrated for non-physics operations. Total experimental hours accumulated for particle physics in the three end stations exceed the actual beam hours for particle physics, indicating that time-interlaced beams are often employed for several experiments simultaneously. Times devoted to various tasks are expressed as percentages of the total manned hours during each quarter. R.B.

N70-16574# California Univ., Livermore. Lawrence Radiation Lab.
THE ASTRON LINEAR ACCELERATOR
J. W. Beal *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 713–723 refs Sponsored by AEC (See N70-16548 05-24)
Avail: CFSTI

The design features of a linear induction electron accelerator, for use in experiments with the Astron, are described. The parameters of the accelerator are: beam energy (4.23 MeV), beam current (1000A), beam pulse length (0.3 micron sec). The design beam emittance is 10pi mr–cm in both transverse dimensions and an energy spread of 2% full–width–half–maximum. The acceleration consists of an increasing gradient gun with an output beam energy of 562 keV, followed by two constant gradient injector sections each adding 220 keV to the beam energy. The remainder of the accelerator is made up of 17 identical accelerator sections, each supplying 190 keV to the beam energy. Solenoidal focusing magnets are positioned with a particular magnetic field strength to provide phase-space matching between the various sections of the accelerator. Steering magnets are placed so as to compensate for the earth ambient magnetic field and possible stray fields. Author (NSA)

N70-16575# California Univ., Berkeley. Lawrence Radiation Lab.
IMPROVEMENTS TO THE BERKELEY HILAC
James M. Haughian *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 725–734 refs Sponsored by AEC (See N70-16548 05-24)
Avail: CFSTI

It is proposed to lengthen the HILAC prestripper cavity to 20 feet, operate at a maximum electric gradient of 640 kV/ft, and utilize magnetic quadrupole drift tube focusing. This system will be capable of accepting ions with charge-to-mass ratios as low as 0.095, thereby taking advantage of increased source output at lower e/m ratios and providing greater transmittance thru the cavity. The proposed system is expected to produce a krypton beam approximately 500 times more intense than considered possible with the existing system. Author

N70-16576# Heidelberg Univ. (West Germany).
STUDY OF A VARIABLE ENERGY HEAVY ION LINEAR ACCELERATOR
Ch. Schmelzer *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 735–744 refs (See N70-16548 05-24)
Avail: CFSTI

After a review of problems typical for heavy ion acceleration, plans for a variable energy heavy ion linear accelerator are discussed. Energy variation is obtained in the last section of the accelerator by adjustable excitation of the individual, equidistant gaps. For uranium ions the accelerator will cover a range from 2 to 9 MeV/AMU. Author (NSA)

N70-16577# Heidelberg Univ. (West Germany).
ELECTRIC QUADRUPOLE FOCUSING IN LINEAR ION ACCELERATORS
K. Blasche, R. Friehmelt, K. Kasper, Ch. Schmelzer, and U. Wolfangel *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 745–754 refs Sponsored by the Federal Ministry for Scientific Research (See N70-16548 05-24)
Avail: CFSTI

The focusing in the first sections of heavy ion linear accelerators may be achieved without the use of grids by employing electric quadrupole lenses. The focusing voltage required can be technically realized and would not exceed + or – 15 kV in the Manchester heavy ion injector linac. Using a low energy proton model, the current yield and radial acceptance of the electric quadrupole focusing system have been studied. The current yield is as high as 34% for the 24 drift-tube linac, and it rises to more than 80% when a buncher is used. A radial acceptance of 80 cm (mrad) is measured. To the first order, the theory is identical for both electric and magnetic fields. In the second order, the focusing is different, since the electric lenses modify the particle energy due to the fringing fields. Computational results concerning the field gradients and the radial acceptance including coupling effects are the bases for the choice of parameters of a heavy ion linac. Author (NSA)

N70-16582 Washington Univ., Seattle.
ACOUSTIC PROPAGATION IN KD-2 PO-4 AT THE FERROELECTRIC TRANSITION TEMPERATURE
Eliyahu Litov (Ph.D. Thesis) 1968 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-7065

The attenuation and velocity of shear waves propagating perpendicular to the polarization axis have been measured in KD2PO4 near the ferroelectric Curie temperature. The results are interpreted in terms of both phenomenological and microscopic theories of relaxation dynamics. The phenomenological interpretation gives new results for both the polarization relaxation time and the electric susceptibility. The microscopic theory makes use of a model which has been described previously by Silsbee, Uehling and Schmidt in the interpretation of the deuteron spin relaxation in this crystal and which is used as a basis for a possible understanding of such other relaxation phenomena as sound attenuation and polarization relaxation. Dissert. Abstr.

N70-16601 Indiana Univ., Bloomington.
THE ELASTIC AND INELASTIC SCATTERING OF PROTONS FROM B-10 BETWEEN 5 AND 16 MeV
Bruce Allan Watson (Ph.D. Thesis) 1968 194 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-4822

The elastic and inelastic scattering of protons from B-10 was investigated over the energy range of 5.0 - 16.5 MeV. Angular distributions for inelastically scattered protons leading to the 0.717-,

and 1.74-, 2.15-, 3.59-, 4.77-, and 6.04-MeV states in B-10 were measured in 300-keV steps between 5 and 12 meV and in 500-keV steps from 12 to 16 MeV. Yield curves for protons feeding these states were obtained in 100-keV steps from 5 to 16 meV at the five angles 65, 85, 115, 135, and 165 degrees. The differential cross sections for elastically scattered protons, measured at several energies between 5 and 13 MeV, show diffraction-type structure typical of direct interactions. The main feature of the yield curves is a broad resonance centered at about 7.5 MeV bombarding energy with a width the order of 4 MeV. Fine structure is superimposed on this broad resonance. The cross section for formation of the 6.04-MeV state is a factor of five larger than that for any of the lower-lying levels. Dissert. Abstr.

N70-16644 Indiana Univ., Bloomington.
SPIN POLARIZATION OF LOW-ENERGY ELECTRONS SCATTERED ELASTICALLY FROM ATOMS AND MOLECULES
Albert Carl Yates (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-4826

Relativistic and nonrelativistic differential cross sections for argon, krypton, and iodine are computed for the energy range 20eV - 150 keV. The atomic fields are used interchangeably in the two calculations. Contributions to the cross section arising from exchange between incident and atomic electrons are also considered. Relativistic and nonrelativistic comparisons are made, and where available, the experimental data are also reproduced. A number of conclusions regarding relativistic and exchange effects are reached, most noteworthy of which are the low energy exchange effects. A theoretical model of electron spin polarization for electron-molecule collisions is set forth, using the independent atom model description of molecules. The results of several preliminary calculation of I2 and C2H5I for low energy incident electrons are given. Dissert. Abstr.

N70-16645 Pennsylvania Univ., Philadelphia.
A NEW APPROACH TO THE THEORY OF SPHERICAL NUCLEI: THE SELF-CONSISTENT CORE-PARTICLE COUPLING METHOD
Gerard Julius Dreiss (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-5619

Recent experimental results, the measurement of large static quadrupole moments in the first 2+ states of nuclei usually considered spherical, have cast doubt on the phenomenological model of collective nuclear vibrations. This lends interest to attempts to formulate microscopic models of collective motion in atomic nuclei. Self-consistent core-particle coupling method was developed and applied to even-even nuclei. The equations of this method, which is also known as the generalized Hartree – Fock approximation of Kerman and Klein, follow from the spectral decomposition of matrix elements of the equations of motion for single particle creation and annihilation operators. A set of coupled matrix eignevalue equations, whose eigenvectors are made up of single particle coefficients of fractional parentage connecting even-even core nuclei to neighboring odd nuclei emerge. Dissert. Abstr.

N70-16646 California Inst. Of Tech., Pasadena.
PI ZERO PHOTOPRODUCTION FROM HYDROGEN BETWEEN 574 AND 1211 MeV
Franklin Bruce Wolverton (Ph.D. Thesis) 1968 284 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 69-5694

Cross section angular distributions for neutral pion photoproduction from hydrogen were measured for 28 laboratory photon energies, from 574 to 1211 MeV. A magnetic spectrometer was used to measure the momentum and angle of the recoil proton. A scintillation counter hodoscope with lead convertors was used to detect the presence of at least one of the neutral pion decay gamma rays. For a majority of the measurements the neutral pion rates were separated from a contamination of pi pair rates using the difference in their distribution among the gamma counters. For the remainder of the measurements, charged pi pairs were eliminated using veto counters in front of the gamma counters. Internal consistency and comparison with other experiments indicate that the veto data are 10 to 15 percent low near 90 deg in the region of 750 MeV. The remainder of the data show good internal consistency and fair agreement with data of other experiments. Dissert. Abstr.

N70-16653 Pittsburgh Univ., Pa.
MEASUREMENT OF THE STATIC AND TRANSITION ELECTRIC QUADRUPOLE MOMENTS OF THE FIRST 2(+) STATE IN Cd-114, Pt-194, Pt-196, AND Pt-198, BY MEANS OF COULOMB EXCITATION
John Edward Glenn (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-6408

The ratio of inelastically scattered O-16 ions exciting the fist 2(+) state to elastically scattered ions has been measured as a function of scattering angle for the even–even isotopes Cd-114, Pt-194, Pt-196, and Pt-198 using a 42-MeV O-16 beam from a tandem Van de graaff. From precise measurements of this kind it is possible to deduce the reduced transition probabilities and the static quadrupole moments of the first 2(+) states for these nuclei. The scattered ions were energy analyzed by means of an Enge split-pole spectograph and detected by position sensitive detectors. Dissert. Abstr.

N70-16654 Texas Technological Coll., Lubbock.
HINDERED INTERNAL ROTATION: FINE STRUCTURE OF THE 3 MICRON VIBRATION-ROTATION SPECTRA OF CH SUB 3 SH
Gilbert Lynn Varnell (Ph.D. Thesis) 1968 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-6451

The theory for rotation-hindered internal rotation transitions of molecules with the top symmetric and the frame slightly asymmetric has been extended to include vibration-rotation-hindered internal rotation transitions and has been applied to CH3SH. The extension examines the selection rules and shows that these rules for perpendicular bands depend upon whether the vibration in question produces a changing dipole moment in the top or in the frame of the moelcule. For vibrations in both the top and the frame of the molecule, both sets of selection rules must be applied. For a parallel band the selection rules are the same for both groups. Dissert. Abstr.

N70-16663# Duke Univ., Durham, N.C.
A HIGH RESOLUTION STUDY OF ISOBARIC ANALOGUE STATES IN K-41 AND Na-23
George Albert Keyworth, II (Ph.D. Thesis) 1968 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-3840

Cross sections for the elastic scattering of protons A-40 from 1.63 to 2.60 MeV and by Ne-22 from 0.80 to 3.13 MeV were measured. Reaction cross sections were measured wherever obtainable. The A-40 data were taken at 135 deg whereas the Ne-22 data were measured at 90, 105, 120, 135, 150 and 160 deg. An energy resolution of about 250 eV was realized. Two isobaric analog states were seen in each of the compound systems, K-41 and Na-23. These individual fine-structure states were analyzed within the framework of R-matrix theory, and spins, parities, partial and total widths were determined. Spectroscopic factors obtained from these measurements for the analog states agree quite well with those previously measured for the parent states from (d,p) stripping on the same target nuclei. In addition, these definite spin and parity assignments resolve previous ambiguities regarding assignments to the parent states. Dissert. Abstr.

N70-16685 California Univ., Los Angeles.
AN EXPERIMENTAL STUDY OF THE PRODUCTS OF COLLISIONS OF 1-ev ATOMS WITH SURFACES
Joseph Patrick Callinan (Ph.D. Thesis) 1968 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-3905

An experimental system for studying the gaseous products of collisions of intermediate energy (1-10 ev) atoms with surfaces is developed. From the experimental time-of-flight (TOF) data the particle, momentum, and energy fluxes as well as the mean speed and mean energy of the scattered atoms are computed. The experimental results for the scattering of neutral Argon atoms from mica and vacuum deposited silver surfaces are presented and compared with other experimental results and with theory. Of the several experimental conditions which were varied, only the type of surface and the molecular-beam incidence angle produced significant changes in the spatial distributions of the computed results. A supraspecular lobe appears in the flux distributions for scattering from mica but not for scattering from silver surfaces. The effect of reducing the angle of incidence from 60 deg to 0 deg was the coalescing of multiple lobes into a single lobe oriented in the normal direction. Dissert. Abstr.

N70-16696 Louisiana State Univ., Baton Rouge.
THE MAGNETOACOUSTIC EFFECT IN MERCURY
Tommy Earl Bogle (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-4453

Geometric resonances in the ultrasonic attenuation have been observed in high purity mercury single crystals with longitudinal sound waves propagated along five crystallographic directions at frequencies up to 165 MHz. The dominant resonance branches have been assigned to calipers of the second band electron lens-shaped surfaces with three major symmetry calipers being obtained. The remainder of the resonance branches have been assigned to orbits on the first band hold surface. Various breakthrough dimensions of the hole surface were determined from these orbits. The pseudopotential coefficients corresponding to the planes bounding the first Brillouin zone in mercury have been estimated by comparing the geometric resonance data with the results of a four pseudowave calculation neglecting spin orbit coupling. Dissert. Abstr.

N70-16711 California Inst. of Tech., Pasadena.
TOTAL CROSS SECTION MEASUREMENTS FOR He-3(He-3,2p)He-4 AT LOW ENERGIES
Mimira Ramarao Dwarakanath (Ph.D. Thesis) 1969 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-5686

Precise measurements of the total reaction cross section for He-3(He-3,2p)He-4 have been made in the range of center-of-mass energies between 1100 keV and 80 keV. A differentially pumped gas target modified to operate with a limited quantity of the target gas was employed to minimize the uncertainties in the primary energy and energy straggle. Beam integration inside the target gas was carried out by a calorimetric device which measures the total energy spent in a heat sink rather than the total charge in a Faraday cup. Proton energy spectra have been obtained using a counter telescope consisting of a gas proportional counter and a surface barrier detector and angular distributions of these protons have been measured at seven bombarding energies. Cross section factors have been calculated from the total cross sections and fitted to a linear function of energy over different ranges of energy. Author

N70-16712 California Univ., Berkeley.
POLARIZATION IN p-He-3 SCATTERING BETWEEN 10 AND 20 MeV
William Frederic Tivol (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-3711

Using the polarized beam facility of the 88-inch isochronous cyclotron at Berkeley, we have investigated the polarization of protons in the elastic scattering of polarized protons on He-3. Four pairs of detectors were arranged around a target gas cell to count protons. These consisted of phototubes on which were mounted CsI crystals ground to a thickness approximately 50% greater than the range calculated for the protons. The signals from the detectors were routed into two 400-channel pulse height analyzers thereby separating the elastic peak from inelastic background. Backgrounds were low enough to permit an unambiguous treatment of the spectra. A solenoid magnet was used to flip the protons, spins in order to cancel any geometric asymmetries. In particular, triple scattering experiments, which determine spin correlation parameters, are especially necessary. Author

N70-16732 Arizona Univ., Tucson.
NEGATIVE PION + PROTON ELASTIC SCATTERING NEAR .893 AND 1.03 BeV/C
William Redin Dawes (Ph.D. Thesis) 1968 42 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-5419

Fluctuations observed in the cross sections of low energy nuclear scattering experiments have been successfully explained by assuming the reaction is dominated by a statistical process. This experiment examined the negative pion + proton elastic scattering reaction at five incident pion momenta ranging from 1.02 to 1.06 BeV/c to determine if there were any fluctuations that could be explained by a statistical process. Within the errors of the experiment, no fluctuations of this nature were observed. Spark chambers were used to determine the differential cross sections. Of the 1,800 elastic scattering events measured at a nominal momentum of 1.03 BeV/c, 1,030 had their incident pion momenta determined to .1%. These events were grouped into five momentum bins and examined for fluctuations over small changes in incident pion momenta. Six hundred negative pion + proton elastic scattering events were measured at .893 BeV/c. Author

N70-16736 Utah Univ., Salt Lake City.
IMPLICATIONS OF A NEW PRODUCTION PROCESS OF FROM 10 TO THE 12th POWER TO 10 TO THE 13th POWER EV MUONS
Grant William Mason (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-6008

Data on zenith-angle dependence of cosmic ray muon intensities in the energy range 1 to 10 TeV have been gathered using a kiloton neutrino detector. Analysis of the zenith-angle dependence suggests that the muon flux consists of a component from the decay of pions and kaons and a component from the decay of a short lived massive new particle. A simple model is proposed and a differential muon spectrum is calculated. Survival probabilities for muons of energy e to reach depth h are calculated to within an estimated 5 per cent by a Monte Carlo technique and are used to compare the calculated muon spectrum with measured intensities at slant depths. A hand-drawn vertical depth intensity curve drawn through data points of other workers is also used as a datum. Dissert. Abstr.

N70-16747 Maryland Univ., College Park.
OFF-MASS SHELL CORRECTIONS TO PION-NUCLEON SCATTERING AMPLITUDES
Joel Carl Ketzin (Ph.D. Thesis) 1968 48 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-16659

Off-mass shell corrections to pion-nucleon scattering amplitudes are calculated using fourth order perturbation theory. A comparison is made to a prescription formulated by Adler. Author

N70-16758 Oregon Univ., Eugene.
ANGULAR DISTRIBUTION, LIFETIME, AND BRANCHING RATIO MEASUREMENTS IN THE P-31 (p,gamma) S-32 REACTION
Carl Joseph Piluso (Ph.D. Thesis) 1968 191 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-8658

Gamma-ray spectra were measured with a 20 cc Ge(Li) detector at the 1.248-, 1.438-, 1.556-, and 1.583-MeV resonances in the reaction to determine the energies and branching ratios of the levels populated in S-32. The lifetimes of 9 levels in S-32 were determined by measuring the Doppler shifts of the gamma rays emitted by the bound states at the 1.556- and 1.438-MeV resonances. Angular distributions of the stronger primary and secondary gamma rays were obtained with the Ge(Li) detector at the 1.248- and 1.438-MeV resonances. To determine spins and mixing ratios involved in the decays, the experimental data were analyzed by chi square methods with a computer program which calculates the theoretical distributions as a function of formation and decay mixing ratios. The method of analysis and the utility of Ge(Li) detectors for such measurements are discussed. The nucleus S-32 seems to exhibit the phenomenon of nuclear coexistence, similar to but in an inverted order from that which has been suggested for O-16. Dissert. Abstr.

N70-16797 Arizona Univ., Tucson.
OBSERVABLE SINGLE PARTICLE STATES IN QUANTUM FIELD THEORY
Larry Zane Kennedy (Ph.D. Thesis) 1968 45 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-5408

An interpretation of field theory in the formulation of Wightman is considered. Based on infinitely differentiable wave functions of compact support, this interpretation implies a unique association of a wave function with each observable state, and therefore allows a definition of the transition probability between two states which satisfies causality. For single free particle states, a calculation of the transition probability using Gaussian wave functions shows that this interpretation establishes the conservation of momentum, the existence of the classical trajectory, and the quantum mechanical spreading of the wave packet. Also, a more complicated mass distribution yielding two particles is discussed. Dissert. Abstr.

N70-16799# Columbia Univ., New York. Dept. of Physics.
PEGRAM NUCLEAR PHYSICS LABORATIES Progress Report, Jan.–Dec. 1968
Dec. 1968 138 p refs
(Contract AT(30-1)-GEN-72)
(NYO-72-227) Avail: CFSTI

Progress is reported on investigations of neutron resonance energies in intermediate range for neodymium isotopes, mass and energy distributions of fragments from neutron fission of plutonium 239 and plutonium 240, Mossbauer spectra of tantalum 186 in tungsten selenide and tungsten sulfide, time-of-flight spectra for epithermal neutron resonances in uranium 233, and design of time pulse analyzers for neutron time-of-flight spectrometer at Nevis synchrocyclotron. NSA

N70-16801 Arizona Univ., Tucson.
FINITE TRANSFORMATIONS OF SU3
Douglas Francis Holland (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-4047

The properties of SU3 finite transformations are investigated. These transformations on the defining three dimensional complex space are parameterized in a form employing three factors, two of which are the Euler parameterization of an SU2 subgroup. The irreducible representations of the factored parameterization are found explicitly. The formula for the volume element is derived, and the volume element is calculated for all parameterizations discussed. The orthogonality relation is verified for the factored parameterization. Symmetries of the transformation matrices are discussed. A definition of triality results and a proof that it is additive modulus three follows. Spherical harmonic basis states are derived as a specialization of the transformation matrix. Differential equations representing the infinitesimal generators are used to derive the infinitesimal generators of Biedenharn. Dissert. Abst.

N70-16812 Pittsburgh Univ., Pa.
INVESTIGATION OF THE REACTION MECHANISM OF THE S-32(d,p ALPHA)Si-29 GROUND STATE REACTION AT BOMBARDING ENERGIES OF 12.0 AND 17.0 MeV
John Andrew Burke (Ph.D. Thesis) 1968 48 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6393

Coincident protons and alpha particles were detected using solid state detectors, and their correlated energy spectra were analyzed by a 64 × 64 channel pulse-height analyzer. Measurements were carried out at various angular combinations. The angular dependence of the differential cross section and the shapes of the energy spectra were compared with the results of some simple model calculations. It was found that at a bombarding energy of 12.0 MeV, the reaction proceeds mainly by a double evaporation process, although for small proton angles a significant contribution of a direct (d,p) reaction, followed by an alpha evaporation, is visible. At a bombarding energy of 17.0 MeV the reaction mechanism is predominantly the latter direct-evaporation process. Dissert. Abstr.

N70-16823 California Inst. of Tech., Pasadena.
RELATIVISTIC QUARK MODELS AND THE CURRENT ALGEBRA
Roger Calvert Hill (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-5687

Representations of the algebra of SU(3) vector and axial-vector charge densities at infinite momentum describe the mesons, idealizing the real continua of multiparticle states as a series of discrete resonances of zero width. Such representations would describe the masses and quantum numbers of the mesons, the shapes of their Regge trajectories, their electromagnetic and weak form factors, and pion emission or absorption amplitudes. Assuming that the mesons have internal degrees of freedom equivalent to being made of two quarks, models in which the mass is SU(3)-independent and the current is a sum of contributions from individual quarks are developed. Dissert. Abstr.

N70-16836# Massachusetts Univ., Amherst.
STUDY OF SIGMA HYPERSON(–) + PROTON YIELDS LAMBDA HYPERSON + NEUTRON AND SIGMA HYPERSON (–) + PROTON YIELDS SIGMA HYPERON (O) + NEUTRON REACTIONS AT P SUB SIGMA(+) BETWEEN O AND 600 MeV/c
S. Steven Yamamoto, David Stephen, Gerald W. Meisner, Richard R. Kofler, Stanley S Hertzbach et al 4 Sep. 1969 13 p refs Presented at Intern. Conf. on Hypernucl. Phys., Argonne, Ill., 5–7 May 1969
(Contract AT-(30-1)-3651)
(NYO-3651-11; Conf-690503-5) Avail: CFSTI

Preliminary results are presented for the interactions Sigma hyperon(–) + proton yields Lambda hyperon + neutron and Sigma hyperon(–) + proton yields Sigma hyperon(0) + neutron using polarized Sigma hypersons(–) from the interaction kaon(–) + proton yields Sigma hyperon(–) + pion(+) at 400 MeV/c in a bubble chamber. The branching ratios are listed for various energy ranges. The average Sigma hyperon(–) and Lambda hyperon polarizations are given. NSA

N70-16847 Michigan Univ., Ann Arbor.
ENERGY DEPENDENCE AND SPECTROSCOPY IN THE O-16(p,d)O-15 AND N-15(p,d)N-14 REACTIONS

James Lewis Snelgrove (Ph.D. Thesis) 1968 181 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-5954

A systematic study of the extraction of spectroscopic factors for the (p,d) reaction on light nuclei and the difficulties encountered in obtaining reasonalbe DWBA fits to the shapes of the angular distributions has been made. Deuteron spectra and angular distributions were obtained for the O-16(p,d)O-15 reaction over an angular range of 10 deg to 165 deg in the center-of-mass frame for 25.52, 31.82, 38.63, and 45.34 MeV incident protons using the variable energy proton beam of a sector focused cyclotron. Partial angular distributions were obtained for other proton energies between 21 and 36 MeV. The elastic scattering of protons from O-16 was measured over the same energy range and used to obtain proton optical model parameters. Deuteron optical model parameters for the O-16(d,d)O-16 reaction were obtained from the literature for use in the DWBA exit channel calculations. Dissert. Abstr.

N70-16868 Iowa State Univ. of Science and Technology Ames.
ELECTRON TRANSPORT THEORY USING METHODS OF INVARIANT IMBEDDING
Robert Jay Barrett (Ph.D. Thesis) 1968 77 p
Avail: Univ. Microfilms: HC $2.20/Microfilm $3.00 Order No. 69-4211

As a result of space exploration in recent years there has been increased interest in electron transport theory. In addition the method of invariant imbedding has already been successfully applied to photon and neutron transport problems. In this research the method of invariant imbedding has been applied to electron transport. The reflection and transmission equations have been derived for electrons. With the assumption that reflection and backscattering can be neglected, the transmission equation has been reduced numerically to a system of first order differential equations. In making this approximation a Gaussian quadrature formula is used to reduce the integral terms. The computer solutions to this system of equations were used to illustrate some of the advantages and disadvantages of the application of this method to electrons. The accuracy of the solutions was shown to be highly dependent upon the numerical approximation of the integral terms. Dissert. Abstr.

N70-16869 Ohio State Univ., Columbus.
DIRECTIONAL CORRELATION OF GAMMA RAYS IN GERMANIUM-72
Wayne Gordon Monahan 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-4941

The gamma rays of Ge72 following the beta decay of 14.1-hour Ga-72 have been studied using a 20-cu cm Ge(Li) detector in coincidence with a 2 in. x 2 in. NaI(Tl) crystal. Major features of the decay scheme have been confirmed by the coincidence measurements. Directional correlation measurements have been carried out on the cascades involving the 630, 849, 1231, 2202, 1491 and 2508-keV gamma rays with the 834-keV groundstate transition from the first-excited 2(+) state. 1-3 directional correlation measurements (with the intermediate gamma ray unobserved) have been made between gamma rays of energy 601, 781, 1000, 1051, 1215, 1597 and 1861 keV and the 834-keV transition. Spin assignments of 2 for the 1464 and the 3036-keV levels have been confirmed. The 630 and 2202-keV transitions are nearly pure E2 and E1 respectively. The level at 2065 keV has been assigned a spin of 3. The 601-keV transition has a maximum M1 admixture of 10%. Dissert. Abstr.

N70-16870 Washington State Univ., Pullman.
THE MOLECULAR ELECTRONIC STRUCTURE OF URAZOLE
Robert William Kramling (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-3775

An outline of the method of application of quantum mechanics to the electronic structure of molecules is given. Selfconsistent field theory is discussed in some detail. An all-electron SCF-LCAO-MO wavefunction using a Gaussian basis is presented for the ground state of the urazole molecule. All electrons, sigma and pi, are considered, and all of the many-center integrals are evaluated. The wavefunction was analyzed from a Mulliken population analysis and from electron density maps. It was found that there is not a complete separation between the energy eigenvalues of the sigma and pi molecular orbitals, and, in fact, the lowest pi molecular orbitals are buried several MO's deep in the sigma energy eigenvalue structure. There is significant delocalization of charge found in the sigma molecular orbitals, contrary to popular belief. Dissert.Abstr.

N70-16872# Japan Atomic Energy Research Inst., Ibaraki. Div. of Radioisotope Production.
DIVISION OF RADIOISOTOPE PRODUCTION Annual Report, Apr. 1968 –Mar. 1969
Jul. 1969 80 p refs In JAPANESE; ENGLISH summary
(JAERI-5023) Avail: CFSTI

Progress in the production technique and shipping of radioactive isotopes was evaluated. Four new items were added to the list of products. These were Cu-64-2R, Br-82-2, Sb-124-1 and Cs-124-1 and Cs-134-1. Among these, Cu-64-2R was the most unique item produced with originally developed method by applying Szilard-Chalmers effect. The shipped amount of radioactivities in the first quarter was 1.65 times of that of the corresponding period of the preceding year. Although this tendency of increment was cut by the unscheduled shut-down of JRR-2, the total shipped amount could maintain the three quarters of that of the preceding fiscal year by trying to change JRR-2 irradiation for JRR-3 irradiation. The structure for safety control in the radioisotope production laboratory was investigated in order to improve its effectiveness, and the safety guides for the works in the laboratory were established. Especially, it was tried to organize the system of the safety control for the out of working time, and was succeeded. Author

N70-16875# New York Univ., N.Y. AEC Computing and Applied Mathematics Center.
TECHNICAL SUMMARY FOR TASKS 1 AND 5 ALSO ADMINISTRATIVE AND FINANCIAL SUMMARY FOR THE ENTIRE CONTRACT Progress Report, 1 Jan.–30 Jun. 1969
8 Sep. 1969 18 p refs
(Contract AT-(30-1)-1480)
(NYO-1480-122; PR-42) Avail: CFSTI

Research in applied mathematics and mechanics, physics of many-particle systems, and computer operations and programming is outlined. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-16521# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SPACE, TIME, AND ENERGY DISTRIBUTION OF NEUTRONS AND X-RAYS FROM A FOCUSED PLASMA DISCHARGE Technical Report, Jul. 1967 – Feb. 1969
Melvin J. Bernstein, David A. Meskan, and Hugo L. van Paassen
4 Sep. 1969 38 p refs
(Contract F04701-69-C-0065)
(AD-695456; TR-0066(5220-50)-4; SAMSO-TR-69-304) Avail: CFSTI CSCL 20/9

The energy spectrum and spatial distribution of neutrons emitted by a plasma focus device was measured with nuclear emulsions and scintillation detectors, and the results are reported. X-ray intensity measurements were made for x-ray energies of 7

< E sub p < 30 keV and showed an 1/(E sub p) squared dependence which does not agree with plasma Bremsstrahlung, but appears to result from anode bombardment of axially-accelerated electrons with energies >200 keV. The line radiation corresponded to that of fairly cold ions. Author (TAB)

N70-15548# ARO, Inc., Arnold Air Force Station, Tenn.
NUMERICAL STUDY OF THE EARLY POPULATION DENSITY RELAXATION OF THERMAL HYDROGEN PLASMAS Final Report, 1 Jul. 1968 – 1 Mar. 1969
C. C. Limbaugh, W. K. Mc Gregor, Jr., and A. A. Mason AEDC Oct. 1969 60 p refs
(Contract F40600-69-C-0001)
(AD-695472; AEDC-TR-69-156) Avail: CFSTI CSCL 20/9

The purpose of this investigation was to examine the early relaxation of the population density distribution of a thermal hydrogen plasma. The system of rate equations describing the transient behavior of all quantum levels was used and solved numerically. Three hypothetical hydrogen plasmas were studied, each with an excitation temperature of 10,000 degrees K. Two of the plasmas differed only by the transition probability of the quasi-metastable 2S1/2 eigenstate, whereas the third case used a different initial population density distribution. The plasmas were used to study the fundamental consistency of the mathematical model, the existence and location of the critical level, relaxation to the quasi-steady state, and a quantitative study of the effects of the quasi-metastable level on the excited state population density distribution. The results show that the model is consistent with fundamental theory under strong collision dominance and that the critical level does exist at that level predicted by earlier investigators. Author (TAB)

N70-15617*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF A LOW FREQUENCY INSTABILITY AND MODIFIED PIG DISCHARGE [EXPERIMENTELLE UND THEORETISCHE UNTERSUCHUNG EINER NIEDERFREQUENTEN INSTABILITAET IN EINER MODIFIZIERTEN PENNIG-ENTLADUNG]
F. Klan Washington NASA Dec. 1969 89 p refs Transl. into ENGLISH from the German report
(Contract NASw-1692)
(NASA-TT-F-12648; IPP-3/92) Avail: CFSTI CSCL 20I

A low-frequency instability observed in a modified PIG discharge is identified to be an m = 1 distribution of the electron temperature moving approximately with the drift velocity around the discharge axis. This abnormal temperature distribution is not accompanied with a similar density distribution. The rotating zone of elevated electron temperature causes an amplitude modulation of most of the observable quantities such as floating potential of probes, discharge current and intensity of the emitted line radiation. Similar phenomena could be observed introducing periodically a small temperature perturbation in the originally stable plasma by local microwave heating. To explain the observed instability, a linear perturbation theory is developed based on the electron energy equation including appropriate source terms. From this theory a dispersion relation is obtained the real part of which gives the phase velocity of the temperature perturbation, whereas, the imaginary part may be used to give a stability criterion. It is found that the phase velocity of the perturbation should be nearly equal to the drift velocity of the electron gas, and that the amplitude may grow exponentially in time if the magnetic field is sufficiently high and the neutral gas pressure is low enough. Both of these results are in good quantitative agreement with the experiments. Author

N70-15624# California Univ., La Jolla. Dept. of Aerospace and Mechanical Engineering Sciences.
EFFECTS OF DYNAMIC ION SHIELDING ON THE STARK BROADENING OF SPECTRAL LINES
S. Rand 23 Oct. 1968 10 p refs
(Contract DA-31-124-ARO(D)-257)
(AD-694795; AROD-5133-219-P) Avail: CFSTI CSCL 20/9

Correlations among the charged particles in a plasma cause a modification of the Holtzmark distribution for the Stark broadening of spectral lines. Due to incomplete ion-ion shielding, the contribution to the electric microfield at a radiating atom, produced by a given ion, depends upon the state of motion of that ion. With the inclusion of this effect, a line shape is obtained which is similar to the shape obtained without this effect, except that it corresponds to a different plasma temperature. Thus if the electron and ion temperatures are the same, and if the Stark line shape is used to determine the plasma temperature, it is demonstrated that the inclusion of dynamic shielding effects will improve the temperature measurement by about 50 per cent. Corrections are obtained as a function of the electron-ion temperature ratio. Author (TAB)

N70-15641*# California Univ., Los Angeles. Plasma Physics Group.
THEORY OF STABILITY OF LARGE AMPLITUDE PERIODIC (BGK) WAVES IN COLLISIONLESS PLASMAS
Martin V. Goldman Jun. 1969 34 p refs Submitted for publication
(Grant NGR-05-007-116; Contracts AT(11-1)-34; Nonr-4756(01); Grant NSF GP-6817)
(NASA-CR-107694; AD-691747; R-52) Avail: CFSTI CSCL 20I

A method is developed for examining the stability of a large amplitude periodic BGK wave, EO, in a collisionless plasma. Vlasov's equation is integrated by the method of characteristics to yield a polarization charge density response, linear in a small-amplitude field El, but nonlinear in Eo. The susceptibility linking charge density response El is expressed in terms of the exact orbits of trapped and untrapped particles in the field Eo, distributed in energy according to the assumed BGK distribution function, Fo. These susceptibilities couple the Fourier components of El in the usual mode-coupling fashion, but trapping effects are now included. For fields Eo which are not too large, the mode-coupling problem reduces to finding the zeroes of a 2 × 2 or 3 × 3 determinant. Distribution functions which are localized at the bottom of the potential energy troughs of Eo give identically the growing side-band instability of Dawson, Kruer, and Sudan. Author (TAB)

N70-15650# Avco-Everett Research Lab., Everett, Mass.
RESEARCH ON INERT GAS MFD ENERGY CONVERSION Final Report
Jean F. Louis Wright-Patterson AFB, Ohio. ARL May 1969 116 p refs
(Contract AF-33(615)-3413)
(AD-694529; ARL-69-0076) Avail: CFSTI CSCL 10/2

The report contains a discussion of the results of a research program to determine the bulk properties of plasmas in the MFD disk generator driven by a high temperature, large mass flow, alkali shock tunnel. Also, the performance of the MFD disk generator is examined as a promising high Hall coefficient, high power density MFD power generator. Specifically, the study phases are: Theoretical studies of two-temperature plasmas operating at high Hall coefficients; one-dimensional analysis of non-equilibrium flows in a MFD disk generator; theoretical study of the MFD disk generator as a practical power generator; description of the large MFD generator facility; experimental studies of high Hall coefficients in an argon-driven generator; experimental studies of an argon-driven generator with upstream pre-ionization; experimental studies of a nitrogen-driven generator. Author (TAB)

N70-15666# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
RESISTIVE DRIFT WAVES IN AN INHOMOGENEOUS ADIABATIC PLASMA
Gerhard Auer and Ferdinand Cap, ed. 15 Jul. 1969 18 p refs

(Contract F61052-67-C-0014)
(AD-694110; UNICP-SR66; AFOSR-69-2437TR) Avail: CFSTI
CSCL 20/9

The propagation of drift waves in an inhomogeneous plasma immersed in a strong magnetic field has been studied. The analysis is based on a macroscopic two-fluid model. Electron inertia and finite resistivity are taken into account. The equilibrium configuration is characterized by a density gradient perpendicular to the magnetic field. The dispersion relation for the normal modes is derived under the assumption of adiabatic behavior of the plasma. Author (TAB)

N70-15742# Grumman Aircraft Engineering Corp., Bethpage, N.Y.

RADIATIVE MODES OF OSCILLATIONS IN A MAGNETOPLASMA COLUMN

Kiu S. Suh Nov. 1969 24 p refs
(RE-372) Avail: CFSTI

The radiative modes of electromagnetic wave oscillation in a cold magnetoplasma column are investigated by analyzing the dispersion relations for various cases. Numerous radiative modes that exhibit essentially the same behavior as those of the magnetoplasma slab are shown to exist. Author

N70-15802# Institut National des Sciences et Techniques Nucleaires, Saclay (France).

EQUILIBRIUM AND STABILIZATION PROBLEMS, VOLUME 4

Jan. 1968 229 p refs Partly in FRENCH; partly in ENGLISH Presented at 2d Intern. Conf. on Interactions between Oscillating Fields and Plasmas, Saclay, France, 15 – 19 Jan. 1968
(Conf-680113-Vol-4) Avail: AEC Depository Libraries

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7. UTILIZATION OF MHZ-BAND ELECTROMAGNETIC WAVES FOR STABILIZATION AND CONFINEMENT OF PLASMA G. B. Levadnyi, D. V. Orlinskii, S. M. Osovets, E. L. Pavlov, L. A. Popov et al p 1147 – 1172 ref (See N70-15809 05-25)

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10. STEADY-STATE EFFECTS OF A HIGH-AMPLITUDE ELECTROMAGNETIC FIELD ON PLASMA C. Etievant, I. Fidone, and F. F. Chen p 1219 – 1243 refs (See N70-15812 05-25)

11. EQUILIBRIUM OF A PLASMA COLUMN IN A ROTATING MAGNETIC FIELD R. Nakach p 1245 – 1262 refs (See N70-15813 05-25)

N70-15803# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).

SURVEY OF RESEARCH AT LABORATOIRE DE RECHERCHES SUR LA PHYSIQUE DES PLASMAS

E. S. Weibel *In* Inst. Natl. des Sci. et Tech. Nucl. Equilibrium and Stabilization Probl., Vol. 4 Jan. 1968 p 1047 – 1075 refs (See N70-15802 05-25)
Avail: AEC Depository Libraries

The confinement of plasma by alternating magnetic fields is discussed. The technique uses a rotating magnetic pinch. Diagnostic techniques being used are briefly discussed. Some measurements are given. NSA

N70-15804# Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu.

INFLUENCE OF A HF MAGNETIC FIELD ON PLASMA INSTABILITIES [L'INFLUENCE DE CHAMP MAGNETIQUE HF SUR LES INSTABILITIES]

A. A. Ivanov, L. I. Rudakov, and J. Teichmann *In* Inst. Natl. des Sci. et Tech. Nucl. Equilibrium and Stabilization Probl., Vol. 4 Jan. 1968 p 1077 – 1088 refs In FRENCH (See N70-15802 05-25)
Avail: AEC Depository Libraries

It is shown that a high frequency magnetic field in a given geometry can stabilize or at least reduce the amount of growth of plasma instabilities. The stabilization mechanism of an oscillating magnetic field, perturbation of the distribution function, loss cone and cyclotron instabilities, drift instabilities, and the effect of a multiperiodic high frequency field are discussed. NSA

N70-15805# Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu.

ON THE EFFECT OF A MULTIPERIODIC HF FIELD ON THE TWO-STREAM INSTABILITY IN A COLD PLASMA

J. Teichmann *In* Inst. Natl. des Sci. et Tech. Nucl. Equilibrium and Stabilization Probl., Vol. 4 Jan. 1968 p 1089 – 1093 refs (See N70-15802 05-25)
Avail: AEC Depository Libraries

A brief theoretical analysis shows the stabilizing effect of a multiperiodic hf field in the most simple case of the cold spatially homogeneous plasma. NSA

N70-15806# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica.

SECONDARY CURRENT LAYERS IN ROTATING-FIELD CONFINEMENT

P. C. T. van der Laan *In* Inst. Natl. des Sci. et Tech. Nucl. Equilibrium and Stabilization Probl., Vol. 4 Jan. 1968 p 1095 – 1103 refs (See N70-15802 05-25)
Avail: AEC Depository Libraries

In general, a magnetically confined plasma column is surrounded by a low density plasma. If one changes the direction of the magnetic field near the wall, currents in the low density plasma oppose the penetration of the new field component to the central column. Minimum values of electron temperature and density are given here which an effectively screening secondary current layer is expected, and the motion of this layer is so as to conserve flux and the pitch of the helical field lines. From experimental evidence it is concluded that these conditions are at least partly met. The consequence of this is that some schemes of rotating-field confinement and of dynamic stabilization cannot be realized. The currents in the outside region may be of advantage in other configurations. Author (NSA)

N70-15807# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.

POSSIBILITY OF UTILIZING UHF FIELDS FOR STABILIZING FLUTE INSTABILITIES [SUR LA POSSIBILITE D'UTILISER LES CHAMPS UHF POUR STABILISER L'INSTABILITE DE FLUTE]

V. M. Glagolev, I. N. Khromkov, and N. S. Cheverev *In* Inst. Natl. des Sci. et Tech. Nucl. Equilibrium and Stability Probl., Vol. 4 Jan.

1968 p 1105–1130 refs In FRENCH (See N70-15802 05-25)
Avail: AEC Depository Libraries

The interaction of ultrahigh-frequency fields of a cavity with a plasma in a static magnetic field was studied experimentally. Under this action, a paramagnetic current flows to the surface of the plasma. The growth of the static magnetic field in the interior of the plasma, which was measured, is in agreement with calculations. Possibilities of using paramagnetic effect for stabilizing a plasma flute instability in various systems are discussed. Author (NSA)

N70-15808# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
INDIVIDUAL MOTION OF PARTICLES AND STABILIZATION OF A PLASMA IN PRESENCE OF AN OSCILLATING FIELD [MOUVEMENT INDIVIDUEL DES PARTICULES ET STABILISATION D'UN PLASMA EN PRESENCE D'UN CHAMP OSCILLANT]
A. Samain *In* Inst. Natl. des Sci. et Tech. Nucl. Equilibrium and Stability Probl., Vol. 4 Jan. 1968 p 1131–1146 refs In FRENCH (See N70-15802 05-25)
Avail: AEC Depository Libraries

Whether a plasma mode, rendered unstable by the Landau effect, can be stabilized by the application of an oscillating electromagnetic field is examined. The fundamental frequency variation of the particle motion in the presence of an imposed field is calculated. The stabilizing effect of this is calculated, and it is proved that it is connected very simply with the variation. This conclusion generalized previous results. Finally, the effective stabilization of a confined plasma is discussed. NSA

N70-15809# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow (USSR). Inst. Atomnoi Energii.
UTILIZATION OF MHz BAND ELECTROMAGNETIC WAVES FOR STABILIZATION AND CONFINEMENT OF PLASMA
G. B. Levadnyi, D. V. Orlinskii, S. M. Osovets, E. L. Pavlov, L. A. Popov et al *In* Inst. Natl. Des Sci. et Tech. Nucl. Equilibrium and Stability Probl., Vol. 4 Jan. 1968 p 1147–1172 ref (See N70-15802 05-25)
Avail: AEC Depository Libraries

A plasma column produced by a condenser bank discharge was investigated. The stabilization circuit consisted of four or six rods placed symmetrically around the axis of the discharge chamber in which the plasma column was localized. Pictures of the plasma are given. NSA

N70-15810# Academy of Sciences (USSR), Moscow. Inst. of Physics.
EXPERIMENTAL STUDIES OF CONFINEMENT AND STABILITY OF PLASMA IN STRONG UHF FIELDS [ETUDES EXPERIMENTALES DU CONFINEMENT ET DE LA STABILITE D'UN PLASMA DANS LES CHAMPS UHF INTENSES]
L. M. Gorbunov *In* Inst. Natl. des Sci. et Tech. Nucl. Equilibrium and Stability Probl., Vol. 4 Jan. 1968 p 1173–1201 refs In FRENCH (See N70-15802 05-25)
Avail: AEC Depository Libraries

A short account of fundamental experimental work performed recently on plasma interaction with intense uhf fields is presented. Two experiments are described in which the confinement of a plasma by uhf fields (circular guide and cylindrical cavity) was studied, in the same way as flow of plasma flux across various configurations of uhf fields was studied earlier. The results of the work described show that in the case of a denser plasma the observed phenomena can be explained using the idea of an ultrahigh frequency mean potential. The peculiarities in plasma behavior do not appear owing to the procedure of the field production, or expressly, when the plasma density increases up to the critical level. Author (NSA)

N70-15811# Academy of Sciences (USSR), Moscow. Inst. of Physics.
INTERACTION OF ELECTROMAGNETIC WAVES WITH A PLASMA [INTERACTION DES ONDES ELECTROMAGNETIQUES AVEC UN PLASMA]
L. M. Gorbunov *In* Inst. Natl. Des Sci. et Tech. Nucl. Equilibrium and Stability Probl., Vol. 4 Jan. 1968 p 1203–1217 refs In FRENCH (See N70-15802 05-25)
Avail: AEC Depository Libraries

An account is given of previous work on the interaction of intense electromagnetic waves with a plasma. First, the treatment of small perturbations of a collisionless plasma subject to the action of an intense inhomogeneous high-frequency field is described. Then, work on the parametric amplification of waves in an inhomogeneous plasma situated in a nonuniform high-frequency electric field is discussed. Work on the self-consistent steady-state distribution of plasma in an intense uhf field and on the motion of a plasma under the action of a uhf field is described. NSA

N70-15812# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
STEADY-STATE EFFECTS OF A HIGH-AMPLITUDE ELECTROMAGNETIC FIELD ON PLASMA [EFFETS STATIONNAIRES D'UN CHAMP ELECTROMAGNETIQUE DE GRANDE AMPLITUDE SUR UN PLASMA]
C. Etievant, I. Fidone, and F. F. Chen (Princeton Univ.) *In* Inst. Natl. des Sci. et Tech. Nucl. Equilibrium and Stability Probl., Vol. 4 Jan. 1968 p 1219–1243 refs In FRENCH (See N70-15802 05-25)
Avail: AEC Depository Libraries

Continuous nonlinear effects in the excitation of very large amplitude waves from the heating of a plasma by means of high frequency oscillations are studied. The general equations of the problem are described, using a fluid model and separating the steady-state perturbations from the oscillating perturbations with the help of an averaging technique. A column of cylindrical plasma in a homogeneous magnetic field is considered. The steady-state velocity of each group of particles is evaluated in the case of self-interaction and in the case of a stationary wave. NSA

N70-15813# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EQUILIBRIUM OF A PLASMA COLUMN IN A ROTATING MAGNETIC FIELD [EQUILIBRE D'UNE COLONNE DE PLASMA DANS UN CHAMP MAGNETIQUE TOURNANT]
R. Nakach *In* Inst. Natl. des Sci. et Tech. Nucl. Equilibrium and Stability Probl., Vol. 4 Jan. 1968 p 1245–1262 refs In FRENCH (See N70-15802 05-25)
Avail: AEC Depository Libraries

The self-consistent equilibrium of a plasma column in an oscillating magnetic configuration is established. The effects are described by a statistical approach in which a mean effective potential well is established that determines the distribution function of the particles as a function of the self-consistent field. NSA

N70-15858# Case Western Reserve Univ., Cleveland, Ohio.
A STUDY OF THE DYNAMICS AND STABILITY OF HYDROMAGNETIC SHOCK Final Report, 1 Feb. 1965–30 Jun. 1968
Oswan K. Mawardi, Richard B. Block, Altan Ferendici, Ronald M. Scott, Fred Mayer et al 1 Aug. 1969 10 p refs
(Contract AF 19(628)-4390)
(AD-694096; AFCRL-69-0327) Avail: CFSTI CSCL 20/9

This report describes theoretical and experimental investigations on preionization by high-power microwave, precursor waves in shocks, turbulent heating in shocks, stability and shock structure. Brief descriptions of a number of separate investigations undertaken in these areas are presented. Author (TAB)

N70-15874# Vanderbilt Univ., Nashville, Tenn. Dept. of Physics.
PLASMA FRONT STUDIES Final Report

John Paul Barach 18 Sep. 1969 8 p refs
(Contract AF-AFOSR-1543-68)
(AD-694106; AFOSR-69-2320TR) Avail: CFSTI CSCL 20/9

Shock flow studies explaining the absence of separated shock flow by Taylor instability are mentioned. Also summarized are flux transport and arc spectroscopy experiments. In the latter, 4 eV plasmas are produced. New experiments with magnetically boosted shock tubes, with shocks in current-carrying plasmas and with high field theta pinch devices are mentioned. Author (TAB)

N70-15880# Air Force Systems Command, Wright-Patterson AFB, Ohio. Avionics Lab.

TRANSIENT SIGNAL PROPAGATION IN ANISOTROPIC PLASMAS

Carl T. Case and Richard E. Haskell (Oakland Univ.) Aug. 1969 29 p refs
(AD-695798; AFAL-TR-69-137) Avail: CFSTI CSCL 20/9

The long time transient response of a lossless, anisotropic plasma to a short electromagnetic pulse is given. The solution is obtained using the asymptotic saddle-point method and is restricted to the cases of propagation parallel to and those perpendicular to the static magnetic field. The results indicate that natural oscillations occur and that these oscillations asymptotically approach the plasma cutoff and resonance frequencies for long times. In addition, complicated transient polarization effects are present in the response signal. Author (TAB)

N70-15888# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.

SPECTROSCOPIC DETERMINATION OF ELECTRON AND ION TEMPERATURES IN STEADY-STATE HELIUM AND ARGON PLASMAS

Stanley L. Leonard 30 Sep. 1969 31 p refs Revised
(Contract F04701-69-C-0066)
(AD-694063; TR-0066(9220-02)-2; SAMSO-TR-69-296) Avail: CFSTI CSCL 20/9

Spectroscopic measurements of electron and ion temperatures in steady-state helium and argon plasmas are reported. Electron temperatures were determined on the basis of coronal equilibrium from measured ratios of the intensities of spectral lines emitted by ions in different stages of ionization. Measurement of the doppler-broadened widths of spectral lines by means of a pressure swept Fabry-Perot interferometer were used to obtain ion temperature values. Evidence is presented to indicate that the populations of excited states of neutral helium are governed by an influx of background neutral particles. It is also shown that excited-state populations of singly-ionized argon obey coronal equilibrium. Author (TAB)

N70-15889# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.

MILLIMETER AND NANOSECOND RESOLUTION OF FAST NEUTRONS FROM AN INTENSE PLASMA DISCHARGE Research Report, May 1968 – Feb. 1969

Melvin J. Bernstein 1 Jul. 1969 19 p refs Revised
(Contract F04701-69-C-0066)
(AD-694513; TR-0066(5220-50)-6; SAMSO-TR-69-297) Avail: CFSTI CSCL 18/4

Polyethylene collimators have been used with fast photomultipliers to spatially resolve the source of 2.45 MeV neutrons in a pulsed, dense, high-temperature, deuterium plasma. The axial distribution of the neutron source was measured with a spatial resolution of 2 mm and a time resolution of 3 nsec. A time-of-flight technique was developed to measure the average neutron velocity with just one photomultiplier and two widely separated plastic scintillators. Author (TAB)

N70-15912# Wisconsin Univ., Madison. Dept. of Electrical Engineering.

PLASMA INSTABILITIES AND WAVES EXCITED BY AN ANISOTROPIC ENERGY DISTRIBUTION PRODUCED BY ELECTRON CYCLOTRON RESONANCE Quarterly Progress Report

J. L. Shohet 15 Sep. 1969 20 p refs
(Contract AT(11-1)-1695)
(COO-1695-24; QPR-10) Avail: CFSTI

The purpose of this research is to investigate the ability of a short pulse of electron cyclotron resonance radiation to produce an anisotropic energy distribution of electrons in a plasma, and the instabilities and waves produced by this anisotropy. In particular, the nature of the rf heating mechanism and the behavior of the radiation emitted from the plasma are considered. The electron cyclotron resonance device was operated both in a short rapidly repeating mode, and a long mode to obtain measurements of free–free bremsstrahlung, wall bremsstrahlung, plasma diamagnetism, energetic electron flux, and electron density in the discharge. Theoretical work on developing an expression for the free–free bremsstrahlung from a plasma containing an anisotropic electron energy distribution was continued. Author (NSA)

N70-16074# Miami Univ., Coral Gables, Fla. Dept. of Physics.

HELIOS PROGRAM PROGRESS REPORT

Harry S. Robertson 15 Aug. 1969 19 p refs
(Contract AT(40-1)-3895)
(ORO-3895-7) Avail: CFSTI

Basic data on the design and construction of the Helios device are described. Research on cesium arc plasmas is also briefly discussed. NSA

N70-16113# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.

PARTICLE ACCELERATION BY ELECTROSTATIC WAVES PROPAGATING IN AN INHOMOGENEOUS PLASMA

G. Laval and R. Pellat Sep. 1969 10 p refs
(ONERA-NT-01-11) Avail: CFSTI

The effect of an electrostatic accelerated wave on charged particle motion was investigated. Adiabatic theory is applied to electrons which are trapped in the potential troughs of the wave. It is found that monochromatic electrostatic waves propagating in the inhomogeneous plasma of the magnetosphere can provide an efficient accelerating and precipitating mechanism. Author (ESRO)

N70-16133*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

MEASUREMENT OF PLASMA FLOW RATE WITH A HEAD PRESSURE PIPE [IZMERENIYE SKOROSTI TECHENIYA PLAZMY TRUBKOY POLNOGO NAPORA]

A. A. Voropayev et al Washington NASA Jan. 1970 13 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (Moscow), v. 7, no. 4, 1969 p 633–640
(Contract NASw-1692)
(NASA-TT-F-12768) Avail: CFSTI CSCL 20I

A method of measuring plasma flow rate with a head pressure pipe is examined, as well as a method of measuring static pressure. An Mk-5 capacitor microphone is used to record the pressure variations. The measurements can be made in stationary and nonstationary modes. There is an analysis of the effect of various factors on the accuracy of measurement of the plasma flow rate (viscosity at low Reynolds numbers, pressure gradient effect on the displacement of the effective center of the pipe, turbulence, rate of movement of the sensor through the plasma flow). Radial distributions of the pressure head are introduced, conducted in an arc with a channel diameter of 20 mm at a current of 160 A. Possible systematic errors are discussed. Author

N70-16134# Space Sciences, Inc., Waltham, Mass.

MODIFICATION OF PLASMA BY RAPIDLY EVAPORATING LIQUID ADDITIVES Semiannual Report

Sol Aisenberg, K. W. Chang, and Pung N. Hu Apr. 1969 70 p

refs
(Contract DAHC04-68-C-0031; ARPA Order-553)
(AD-694437; SSI-514) Avail: CFSTI CSCL 20/9

Previous experimental results have shown that liquid additives aspirated into plasma resulted in almost complete recovery of the microwave transmission. In the present study, possible electron removal mechanisms of the liquid additive are investigated theoretically and experimentally. These mechanisms include vaporization of negatively charged molecules, the electron attachment of the vapor as well as the microwave transmission through a highly inhomogeneous plasma. Effects of surface tension and the electrostatic potential of the droplet on the heat of vaporization are analyzed; the former is found negligible and the latter important for droplets of micron (or submicron) sizes. The survival time and distance are studied by considering the vaporization and the acceleration of the droplet for various droplet sizes and additives and the results are then used to determine the electron density along the plasma stream. Measurements are made for the microwave transmission through a synthetic porous plasma for various parameter ranges. Preliminary results agree very well with the previous experimental results on plasma jets and show that appreciable microwave transmission can be obtained through a porous plasma. One interesting conclusion is that it is better to remove free electrons in clumps or pores rather than to remove the same number of electrons uniformly throughout the plasma. Author (TAB)

N70-16144# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.
CROSSED FIELD ACCELERATION OF A MULTI-GAS PLASMA [KREUZFELDBESCHLEUNIGUNG DES MEHRGAS-PLASMAS]
Gisela Stoffers Jan. 1969 26 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-45) Avail: CFSTI

The plasma is treated as a system of several gases flowing in the same space with different velocities and not in thermodynamic equilibrium with each other. Friction forces occurring between the gases are assumed to be continuously distributed in space. For the evaluation of the friction process between two of the gases, their average velocity is defined. The friction force on one of the two gases is proportional to the difference between its own velocity and the average velocity. The technical work done per time unit on the gas, is proportional to the product of the above velocity difference and the average velocity. The frictional work per time unit is proportional to the square product of that difference. Author (ESRO)

N70-16183# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
AN APPROXIMATE CALCULATION OF THE DISTRIBUTION OF FLOATING POTENTIAL ON A DIELECTRIC BODY IMMERSED IN A HIGH DENSITY IONIZED STREAM
Eugene E. Covert and Robert Y. Ting Jun. 1969 30 p refs
(Contract F19628-69-C-0043)
(AD-695484; TR-157; AFCRL-69-0379; SR-3) Avail: CFSTI CSCL 20/9

The conservation equations for electrons and ions, together with the equation for voltage induced by charge separation are studied for the case of a singly ionized fluid flowing along the dielectric body. Since the electrons are more mobile than the ions, a floating potential is induced on the body to reduce electron flux and increase the ion flux. The net current flux to the wall is thus zero. It is shown that this potential varies along the length of the body because of the change in the charged particle flux across the fluid mechanical boundary layer. Author (TAB)

N70-16342*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
PARAMETERS OF A HYDROGEN PLASMA IN A SUPERSONIC SPHERICAL SOURCE [PARAMETRY VODORODNOY PLAZMY V SUERKHZVUKOVOM SFERICHESKOM ISTOCHNIKE]
V. M. Golfarb et al Washington NASA Jan. 1970 8 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (Moscow), v. 7, no. 4, 1969 p 810–814
(Contract NASw-1692)
(NASA-TT-F-12767) Avail: CFSTI CSCL 20I

The results of a numerical integration of a system of equations for a stationary source of nonequilibrium hydrogen plasma are given. Collision radiation recombination is considered to be the governing elementary process. To clarify the effect of resorption a calculation was performed for the cases of optically thin and optically thick plasma for all forms of radiation, and the optically thick plasma only for resonance radiation. In the flow region, considerable disturbance of thermal and ionization equilibrium was observed. Resorption of radiation leads to a considerable deviation of the electron temperature from the temperature of the heavy particles and a decrease in the recombination rate. In a quasistationary approximation, the populations of the hydrogen levels were determined on the basis of the values obtained for the concentration and temperature of the electrons. Author

N70-16356 Texas Univ., Austin.
AN EXPERIMENTAL STUDY OF RADIO FREQUENCY PLASMAS NEAR THE LOWER HYBRID RESONANCE
David Edward Hasti (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-6153

The resistive loading of a steady state RF oscillator, operating at power levels of 3 to 4.5kW in the vicinity of 25 MHz, by inductively coupled argon and hydrogen plasmas is determined experimentally as a function of magnetic field strength. The experimental conditions are designed to match as closely as possible the theory for a finite length, cylindrical plasma in a homogeneous magnetic field coupled to a wave generator through a single turn coil. The experiments covered pressure ranges of 0.050 to 0.260 torr in argon and 0.025 to 0.150 torr in hydrogen. The experimental results are compared with numerical calculations of loading resistince from Skipping's theory and from the loading resistance obtained from the assumption of an infinite length plasma with no propagation along the magnetic field. Dissert. Abstr.

N70-16367 Drexel Inst. of Tech., Philadelphia, Pa.
NONLINEAR LONGITUDINAL PLASMA WAVES
Lan-keh Chi (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-5165

A hydrodynamic approach is formulated for wave motions in a two-component warm plasma. A Lagrangian representation of plasma flows is obtained by applying Von Mises' transformation to the electrohydrodynamic equations. The occurrence and the properties of limiting lines in plasma flows, are investigated. As an example, the development of an initial velocity perturbation in a warm electron plasma is examined. The breaking down of the nonlinear solution is explicitly indicated. Dawson's criterion for the breakdown of nonlinear oscillations in a cold, uniform plasma is extended to nonlinear wave propagations in a warm, non-uniform plasma. Dissert. Abstr.

N70-16385# Institut National des Sciences et Techniques Nucleaires, Saclay (France)
CONFINEMENT AND STABILIZATION BY HF FIELDS ALONE OR ASSOCIATED WITH STATIC MAGNETIC FIELDS. VOLUME 3
1968 253 p refs Presented at 2d Intern. Conf. on the Interactions Between Oscillating Fields and Plasmas, Saclay, France, 15–19 Jan. 1968 Partly in FRENCH; partly in ENGLISH
(CONF-680113-Vol-3) Avail: AEC Depository Libraries

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2. THE THERMONUCLEAR PROSPECTS OF VARIOUS RF CONFINEMENT SCHEMES C. J. H. Watson (Oxford Univ., Engl.) p 919–948 refs (See N70-16387 05-25)

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6. RF PLASMA WORK AT CULHAM LABORATORY: EXPERIMENTAL D. J. H. Wort (UKAEA, Culham, Engl.) p 1037–1046 (See N70-16391 05-25)

N70-16386# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR).

STABILIZATION OF PLASMA BY HIGH-FREQUENCY ELECTROMAGNETIC FIELDS [STABILISATIO D'UN PLASMA PAR DES CHAMPS ELECTROMAGNETIQUES DE HAUTE FREQUENCE]

R. A. Demirkhanov *In* Inst. Natl. des Sci. et Tech. Nucl. Confinement and Stabilization by HF Fields Alone or Assoc. with Static Magnetic Fields, Vol. 3 1968 p 809–918 refs In FRENCH (See N70-16385 05-25)

Avail: AEC Depository Libraries

The possibility of suppressing the hydrodynamic instability and kinetics of a magnetic plasma by high-frequency electromagnetic fields is presented. The results include data for fluted and micro-instabilities. Problems are discussed which are related to the interaction of large-amplitude high-frequency fields with a boundary layer. Also reported are the results of a study on the equilibrium of a plasma boundary in a torus in the presence of quadrupole, helicoidal, high-frequency electromagnetic fields. NSA

N70-16387# Oxford Univ. (England). Merton Coll.

THE THERMONUCLEAR PROSPECTS OF VARIOUS RF CONFINEMENT SCHEMES

C. J. H. Watson *In* Inst. Natl. des Sci. et Tech. Nucl. Confinement and Stabilization by HF Fields Alone or Assoc. with Static Magnetic Fields, Vol. 3 1968 p 919–948 refs (See N70-16385 05-25)

Avail: AEC Depository Libraries

It has recently been shown that although it is impossible to design a thermonuclear reactor of reasonable size in which the plasma is confined by rf radiation pressure within a resonant cavity, the margin by which this method fails is smaller than was once supposed. This paper examines the possibility that the use of relatively low-frequency fields, or high-frequency fields supplemented by static magnetic fields, might in consequence lead to a practicable design. It is shown that low-frequency schemes only have a future if a toroidal static magnetic field is used to provide the main confining force, and that in addition, stringent precautions are taken to minimize ohmic and radiation energy losses. The use of certain slow-wave structures is proposed for this purpose. High-frequency confinement schemes are shown to require a static magnetic field shaped so that magnetic field lines only intersect a small fraction of the surface area of the plasma. Author (NSA)

N70-16388# Argonne National Lab., Ill.

POTENTIAL-WELL THEORY OF CONFINEMENT OF PLASMAS IN NONUNIFORM RADIOFREQUENCY FIELDS

Albert J. Hatch, M. Hasan, and W. E. Smith *In* Inst. Natl. des Sci. et Tech. Nucl. Confinement and Stabilization by HF Fields Alone or Assoc. with Static Magnetic Fields, Vol. 3 1968 p 949–986 refs Sponsored by AEC (See N70-16385 05-25)

Avail: AEC Depository Libraries

The potential of a small plasma sphere in an electromagnetic field is determined as a function of plasma density. For the limiting cases of low- and high-density plasmas, the respective phi and gamma potentials are computed as point functions of the field space. The resulting topological characteristics are then examined for potential wells. Examples are given for spherical and cylindrical resonant cavities. Fusion power possibilities contingent upon the use of superconducting cavities are explored. Author (NSA)

N70-16389# Argonne National Lab., Ill.

FREQUENCY-SHIFTING METHOD OF EXCITING PLASMAS IN FUNDAMENTAL-MODE RESONANT CAVITIES

Albert J. Hatch, S. L. Halverson, and A. E. Froehlich *In* Inst. Natl. des Sci. et Tech. Nucl. Confinement and Stabilization by HF Fields Alone or Assoc. with Static Magnetic Fields, Vol. 3 1968 p 987–1024 refs Sponsored by AEC (See N70-16385 05-25)

Avail: AEC Depository Libraries

A new frequency-shifting method of exciting a plasma in a resonant cavity is described. Shifting the exciting frequency by approximately 10% above the resonant frequency of the empty cavity has resulted in plasma densities about 10 times greater than were obtainable without frequency shifting. Requirements for dynamic stability of a plasma in a resonant cavity are established. The results are essential to the possible eventual rf confinement of plasmas in resonant cavity fields. Author (NSA)

N70-16390# Stichting Voor Fundmenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica.

FREQUENCY SHIFT OF A RESONANT CAVITY AND THE RF FORCE ON A PLASMA

H. J. L. Hagebeuk and C. M. Braams *In* Inst. Natl. des Sci. et Tech. Nucl. Confinement and Stabilization by HF Fields Alone or Assoc. with Static Magnetic Fields, Vol. 3 1968 p 1025–1036 refs (See N70-16385 05-25)

Avail: AEC Depository Libraries

The shift of the resonance frequency of an rf cavity, in which a plasma is present, depends on the strength of a constant magnetic field, and can be zero at a critical field strength above cyclotron resonance. By a suitable choice of the rf mode and the constant magnetic field pattern the plasma can be in equilibrium with these fields. Author (NSA)

N70-16391# United Kingdom Atomic Energy Authority, Culham (England).

RF PLASMA WORK AT CULHAM LABORATORY: EXPERIMENTAL

D. J. H. Wort *In* Inst. Natl. des Sci. et Tech. Nucl. Confinement and Stabilization by HF Fields Alone or Assoc. with Static Magnetic Fields, Vol. 3 1968 p 1037–1046 (See N70-16385 05-25)

Avail: AEC Depository Libraries

The HELIOS device at Culham Laboratory is designed to investigate nonresonant electron heating. Plasma generated by the resonant absorption of 3-cm microwaves forms a well-defined column, around which a slow-wave structure will be placed so as to launch slow waves at 2450 MHz into the plasma. These slow waves will give nonresonant heating. Work has been directed towards the determination of the plasma parameters and development of suitable diagnostic techniques, and to solving various technical difficulties with the slow-wave structure. Author (NSA)

N70-16701 Colorado Univ., Boulder.

KINETIC THEORY AND TRANSPORT PROPERTIES FOR A MAGNETIZED PLASMA

Duk In Choi (Ph.D. Thesis) 1968 156 p

Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-4340

When the external magnetic field is large enough such

that the gyrofrequency becomes of the same order of the plasma frequency, the collision integral of the kinetic equation should account for the effect of the magnetic field on the collision processes. We solve the kinetic equation in the presence of strong magnetic field by the Chapman-Enskog method and obtain the electrical and thermal conductivities and the ion viscosity in the strong magnetic field limit. They show markedly a different behavior from those we obtain using the Boltzmann collision integral. Based on the functional formalism of Brittin-Chappell, where they treat the electric and magnetic field quantities on the same basis as the particle density function in phase space, we derive the general conservation laws. These conservation laws are exact and include the transverse interactions. These conservation laws then provide a rigorous foundation for magnetohydrodynamics. Dissert. Abstr.

N70-16730*# Computer and Applied Sciences, Inc., Philadelphia, Pa.
MHD BOUNDARY LAYERS WITH NON-EQUILIBRIUM IONIZATION AND FINITE RATES Quarterly Report, 1 Mar.–1 Jun. 1969
Arthur Sherman, Hsuan Yeh, and Eli Reshotko 1 Jun. 1969 14 p
(Contract NASw-1866)
(NASA-CR-107671; QR-1) Avail: CFSTI CSCL 20I

The problem being considered is the boundary layer that will develop over the segmented electrode wall in an MHD channel when a nonequilibrium plasma is flowing. A theoretical analysis for a nonequilibrium boundary layer explicitly takes into account the electron temperature differential equation and the plasma sheath. This analysis was developed using a finite difference format so that finite electrodes along a wall could be geared in a nonsimilar manner. Finite ionization and recombination rates are now included in order to make the analysis apply in a more realistic way to physically important situations. Author

N70-16742 Maryland Univ., College Park.
EXPERIMENTAL STUDY OF THE STRUCTURE OF PLASMA SHOCK WAVES IN A FAST THETA-PINCH
John Andrew Stamper (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-4616

The density, temperature, and magnetic field structures of plasma shock fronts have been observed by means of scattered light, a magnetic probe and emission spectroscopy. The shocks and initial hydrogen plasma were generated by capacitor discharges through a single turn coil placed around a cylindrical quartz tube containing hydrogen. The electron velocity distributions were obtained by analyzing the light scattered at 90 deg to the incident beam from a Q-switched ruby laser. The observed temperature structure was compared with that calculated from observed particle and current density by assuming local resistive dissipation due to binary electron-ion collisons. Agreement was good in two cases, but, in a case characterized by lower initial, the velocity distribution developed enhanced wings and enhanced heating occurred. The effects indicate a diffusion of high energy electrons from the hot, downstream region. The electron distribution function was of the same form in the r-z and theta-z directions. Dissert. Abstr.

N70-16837 Maryland Univ., College Park.
ELECTRON AND ION BROADENING OF THE HELIUM SPECTRAL LINES LAMBDA 4471 AND LAMBDA 4026
Harry Anthony Gieske (Ph.D. Thesis) 1968 81 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-7214

Radiation emitted by a hot, partially ionized plasma is indicative of the conditions within the plasma. The energy levels of the constituent atoms are perturbed by the microelectric fields of the ions and electrons so that the emitted spectral lines are broadened by the Stark effect. Stark profiles were calculated for a range of electron densities between 10 to the 15th power and 10 to the 18th power electrons per cc. and for temperatures between 5000 and 40,000 K. The quasi-static approximation was used for ion effects and a generalized impact approximation was used to describe the electron effects. Tabulated profiles are presented which include the fine structure of the lower state. Error estimates show that the profiles are accurate to about 10% Dissert. Abstr.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-15509# Princeton Univ., N.J. Dept. of Electrical Engineering.
SURFACE CONDUCTION IN CDS Technical Report, Mar.–Aug. 1969
Roger T. Baker and Peter Mark Sep. 1969 98 p refs
(Contract N00014-67-A-0151)
(AD-695823; TR-3) Avail: CFSTI CSCL 20/12

Using four terminal current voltage measurements the authors established that for thin crystals of high resistivity CdS all the dark current flows in a thin layer near the surface. It is estimated that the bulk resistivity is at least 100 times higher than the surface resistivity. This natural sandwich structure (two conduction layers separated by an insulating layer) produces several interesting effects including a self-field effect which causes a strong current saturation similar to that seen but not explained by Bube and Barton. After establishing that a surface conductivity existed, Hall and thermoelectric power measurements were made to determine the transport properties of the surface layer. From these measurements it was not possible to determine whether the surface conduction was due to a bent conduction band caused by nonuniform doping, banding of surface impurities, or banding of intrinsic surface states. Examination of the literature on the chemical properties of crystalline CdS indicated that even at room temperature the surface may react with oxygen especially in the presence of bandgap illumination and moisture. Based on the chemical properties of CdS surfaces a general model is proposed to explain some of the electronic properties of CdS. Author (TAB)

N70-15588*# Techtran Corp., Glen Burnie, Md.
DISTRIBUTION OF CONCENTRATION OF CURRENT CARRIERS IN SEMICONDUCTOR SPECIMEN WITH THE HALL EFFECT [RASPREDELENIE KONTSENTRATSIY NOSITELEY TOKA V OVRAZTSE POLUPROVODNIKA PRI EFFEKTE KHOLLA]
A. I. Ansel'm Washington NASA Jan. 1970 11 p refs Transl. into ENGLISH from Zh. Tekhni. Fiz. (Leningrad), v. 22, no. 7, 1952 p 1146–1153
(Contract NASw-1695)
(NASA-TT-F-12698) Avail: CFSTI CSCL 20L

This article presents an analysis of the change in concentration of holes and electrons with the Hall effect in a semiconductor specimen considering volumetric or surface recombination. In many cases, a considerable change in the n concentration occurs with the Hall effect. The authors do not analyze the case when volumetric and surface recombination occur simultaneously. Formulas are presented for determination of the volumetric or surface recombination factors. Author

N70-15681*# Radio Corp. of America, Princeton, N.J.
VAPOR PHASE GROWTH TECHNIQUE AND SYSTEM FOR SEVERAL 3–5 COMPOUND SEMICONDUCTORS
J. J. Tietjen, R. Clough, R. E. Enstrom, and M. Ettenberg Sep. 1969 14 p
(Contract NAS12-538)
(NASA-CR-86306; QTR-8) Avail: CFSTI CSCL 20B

The research has included the vapor growth of AlAs, GaN

GaSb, and In(1-x)Ga(x)P alloys. AlAs, single crystalline layers, were prepared for the first time. These layers are relatively stable in air, and have good optical and electrical properties. GaSb layers have been grown with a mobility of 420 sq cm/v-sec, which is higher than obtained previously. Good control of the composition of In(1-x)Ga(x)P alloys was achieved by adjusting the HCl flows to the Ga and In sources and by selecting the appropriate deposition temperature. The use of InP and GaP substrates reduces strain induced defects caused by mismatch of the thermal expansion coefficient and lattice parameter between the substrate and the epitaxial layer. Increasing the GaN growth temperature to 970 C improved the surface quality, but did not lead to the incorporation of Ge acceptor impurities, so that reproducibility of p-type doping is still a problem. For the first time, single-crystalline GaN layers have been grown on alpha-SiC. Author

N70-15701# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
HIGH PRESSURE EFFECTS IN SOLIDS Final Report, 1 Jun. 1961 – 31 Dec. 1967
W. B. Daniels Oct. 1969 11 p
(Contract DA-31-124-ARO(D)-210; Grant DA-ARO(D)-31-124-G74)
(AD-695695; AROD-3151.6-P) Avail: CFSTI CSCL 20/2

The report summarizes investigations concerned with effect of high pressure on properties of simple solids and with the temperature dependent equation of state of solids. Eight experiments are discussed briefly and include (1) measurement of elastic constants of rubidium iodide as functions of pressure, (2) optical observations of the NaCl-CsCl structure transformation in rubidium iodide at high pressure, (3) the anomalous thermal expansion of germanium, silicon and compounds crystallyzing in the zinc blend structure, (4) the influence of pressure on point defects in alkali halides, (5) temperature dependence of the bulk modulus of germanium and silicon, (6) dielectric constant of rubidium iodide as a function of pressure to the transition pressure, (7) dielectric constants of NaCl and KCl as functions of pressure and temperature down to 16K, and (8) dielectric constant measurements in solid argon at high pressure. Author (TAB)

N70-15725# Lincoln Lab., Mass. Inst. of Tech., Lexington.
Pb2M2O(7-x)(M = Ru, Ir, Re): PREPARATION AND PROPERTIES OF OXYGEN DEFICIENT PYROCHLORES
J. M. Longo, P. M. Raccah, and J. B. Goodenough 31 Jan. 1969 14 p refs
(Contract AF 19(628)-5167)
(AD-693666; JA-3436; ESD-TR-69-233) Avail: CFSTI CSCL 20/2

The preparation and some properties of three oxygen deficient pyrochlores are reported. All show Pauli paramagnetism and metallic conductivity. The dimensions of the face-centered cubic unit cells are: Pb2Ru2O(7-x), 10.253A; Pb2Ir2O(7-x), 10.271A; and Pb2Re2O6, 10.425A. The stability of this defect-pyrochlore structure relative to the perovskite structure is discussed. Author (TAB)

N70-15753# IBM Watson Research Center, Yorktown Heights, N.Y.
TUNNELING SPECTROSCOPY: A SENSITIVE TECHNIQUE FOR STUDY OF THE ELECTRONIC STRUCTURE OF SEMICONDUCTORS AND SEMIMETALS
R. T. Miller 1969 10 p refs
(Contract DA-31-124-ARO(D)-478)
(AD-693785) Avail: CFSTI CSCL 20/12

Electron tunneling and its utilization as a tool in studying the band structure of semiconductors and semimetals are reviewed. TAB

N70-15765*# Illinois Univ., Urbana. Coordinated Science Lab.
TUNNELING MEASUREMENT OF ELECTRON-PLASMON INTERACTIONS IN DEGENERATE SEMICONDUCTORS
C. B. Duke, M. J. Rice, and F. Steinrisser Jun. 1969 40 p refs
(Grant NsG-228-62; Contracts DAAB-07-67-C-0199; DA-31-124-ARO(D)-114)
(NASA-CR-107701; AD-688838; Rept-R-420; Doc-69-C-049) Avail: CFSTI CSCL 20L

The electronic proper self energy due to electron-plasmon interactions in degenerate semiconductors was evaluated using the random phase approximation. This self energy together with elementary models of the barrier penetration factor is used to calculate the tunneling characteristics of rectifying metal contacts on the degenerate semiconductors. Author (TAB)

N70-15774# Sheffield Univ. (England). Dept. of Physics.
ELECTRONIC STRUCTURE OF METALLIC ALLOYS Final Technical Report, Jul. 1966 – Jun. 1969
N. H. March and J. S. Rousseau Jul. 1969 66 p refs
(Contract DAJA-37-68-C-1020)
(AD-693889; E-1258) Avail: CFSTI CSCL 20/12

The electronic partition function from the c-matrix of a hypothetical system of randomly arranged scattering centers is calculated. This result has been generalized to deal with the cases of a pure liquid metal, for which we present results for a model of beryllium, and for liquid binary alloys. It is shown that there are large differences between the partition functions for the random case and that of the crystal; these differences are interpreted as arising from the presence of a low energy tail on the conduction band, together with a spreading out of the tightly bound band. A method is given whereby the extent of delocalization of the tightly bound band may be estimated. Author (TAB)

N70-15784*# Virginia Univ., Charlottesville. Div. of Electrical Engineering.
INVESTIGATION OF THE DETECTIVITY OF RADIATION-PRODUCED DEFECT LEVELS IN n- AND p-TYPE SILICON AND GERMANIUM Final Report
Robert J. Mattauch Jul. 1969 133 p refs
(Grant NGR-47-005-093)
(NASA-CR-66884; EE-4031-103-69U) Avail: CFSTI CSCL 20L

The spectral results for the n-type silicon which occur at the onset of increased photoconductivity for a wavelength of .42eV energy are reported. The spectral results for p-type silicon show the highest spectral response for infrared photons when the energy is greater than .27eV. It is concluded that the black-body responsivity of silicon is high in comparison with that for germanium. In addition, a thesis on the possibility of using irradiated silicon as a photoconductive infrared detector is included. The thesis concludes that irradiated silicon promises definite possibilities as a useable photoconductor. F.O.S.

N70-15787# Sperry Rand Research Center, Sudbury, Mass.
MAGNETOELASTIC LOVE WAVES
H. Matthews and H. van de Vaart Sep. 1969 15 p refs
(Contract N00014-69-C-0027)
(AD-694849; SRRC-CR-69-19) Avail: CFSTI CSCL 20/12

Magnetoelastic surface waves are coupled to Love waves when the substrate is magnetoelastic. The coupling effects a nonreciprocal splitting of the love wave spectrum. Author (TAB)

N70-15852# National Electrotechnical Inst., Turin (Italy).
ON THE THEORY OF THE DESTRIAU EFFECT Final Report
Guido Bonfiglioli, Piero Brovetto, Gianluigi Busca, and Adriana Mojoni Sep. 1969 63 p refs
(Grant AF EOOAR-68-0007)
(AD-694128; AFOSR-69-2442TR) Avail: CFSTI CSCL 20/12

A novel model of the Destriau effect (ac EL in ZnS(Cu)) is presented that looks capable of interpreting in a consistent way all the principal experimental features of EL. This result is obtained through consideration of the semiconducting properties of definite partial dislocations bordering stacking faults in hexagonal structure basal planes. After a thorough critical survey of existing theories, the crystal defect spoken of is described and its properties illustrated, showing how they lead to the occurrence of the Destriau effect. Author (TAB)

N70-15887# Sperry Rand Research Center, Sudbury, Mass.
MICROWAVE AND OPTICAL PROPERTIES OF SELECTED PEROVSKITE MATERIALS Final Report, 1 Aug. 1968 – 31 Jul. 1969
Richard W. Damon, William W. Holloway, Jr., and Michael Kestigian Oct. 1969 44 p refs
(Contract F19628-69-C-0031)
(AD-695490; SRRC-CR-69-17; AFCRL-69-0380) Avail: CFSTI CSCL 20/2

Single crystals of several perovskite materials including CsMnF3, alkali chloride-manganese chloride salts and Er3 Fe5 O12 have been prepared. The Faraday rotation of crystals of Er3 Fe5 O12 have been measured at 1.15 micrometers at room temperature and at liquid nitrogen temperature (i.e., below the compensation point). The use of this material as an optical memory is discussed. The optical properties of single crystals of several chloride salt of manganese have been measured. The results obtained for the fluorescence are compared with measurements on several fluoride salts. Author (TAB)

N70-15919 National Lending Library for Science and Technology, Boston Spa (England).
THE PRODUCTION OF SOME INVESTIGATIONS OF SINGLE CRYSTALS OF THE COMPOUND CdGa SUB 2 S SUB 4
V. B. Antonov et al 28 Jul. 1969 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Azerb. SSR (Baku), v. 24, no. 8, 1968 p 12 – 15
(NLL-RRE-Trans-236-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Parameters and symmetry of growing single crystals of CdGa2S4 were determined by X-ray analysis. The single crystals were obtained by the chemical transport method. A small short wave maximum, at a wavelength equaling 370 nm, and a larger long wave maximum, at a wavelength equaling 470 nm at room temperature, were obtained from an analysis of the spectral distribution of the photoconductivity of the CdGa2S4 crystals. J.M.C.

N70-15924 National Lending Library for Science and Technology, Boston Spa (England).
CONDENSATION OF THE EXCITONIC GAS IN GERMANIUM
V. M. Asnin et al [1969] 12 p refs Transl. into ENGLISH from Zh. Eksperim i Teor. Fiz. (Moscow), v. 9, 5 Apr. 1969 p 415 – 419 In ENGLISH and RUSSIAN
(NLL-M-7767-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Experiments were carried out on the metallization of excitonic gas in germanium which occurs when a rapid increase of electrical conductivity reaches a certain critical value of exciton density. Analog measurements were used to determine whether the metallization of excitons is a phase transition of first order. Specimens of p-type germanium were studied in liquid helium. Electron-hole pairs were created by the light of a pulse lamp and the specimen was illuminated by monochromatic light in the region of wavelengths corresponding to that of the direct transition edge. The experiments show that the observed metallized regions constitute 'drops' of condensed excitons, and the density of the electron-hole pairs in the metallized phase increases as temperature decreases. R.B.

N70-15925 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRICAL PROPERTIES OF p-InP
V. V. Galavanov et al 28 Jul. 1969 7 p refs Transl. into ENGLISH from Fiz. i Tekhn. Poluprovodikov (USSR), v. 3, pt. 1, 1969 p 120 – 122
(NLL-RRE-Trans-244-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Investigations were conducted on the anomalously low hole mobility in heavily doped p-type indium phosphide and on the ratio of the electron and hole mobilities. The effective mass of the holes was evaluated. R.B.

N70-15994# Gulf General Atomic, San Diego, Calif.
THERMAL EXPANSION AND PHONON FREQUENCY SHIFTS IN NON-PRIMITIVE LATTICES
E. Leo Slaggie 1969 56 p refs
(Contract AT(04-3)-167)
(GA-9417) Avail: CFSTI

Expressions were derived in the quasi-harmonic approximation for the change in normal mode frequencies associated with thermal expansion in a nonprimitive lattice. The work is formulated in terms of coupling parameters for an undistorted lattice with cubic anharmonicity. Symmetric finite strain parameters and appropriate internal strains are introduced in such a manner that the formulation exhibits explicitly the invariance of the crystal potential energy and normal mode frequencies to rigid body rotations. As a numerical application, the coefficient of linear expansion and the phonon frequency distributions at 300 and 800 K were calculated for zirconium hydride with a short-range central force model including third-nearest-neighbor forces. Author (NSA)

N70-16047# Wisconsin Univ., Madison.
BASIC RESEARCH ON CYCLOTRON RESONANCE Final Report, 1 Jun. 1966 – 28 May 1969
Richard V. Dexter, A. B. Holand, P. L. Radoff, Boyd Veal, and J. D. Wiley Jun. 1969 72 p refs
(Contract AF 33(615' 5427)
(AD-694124; ARL-69-0085) Avail: CFSTI CSCL 20/12

A variety of experiments on the band structure of semimetals and semiconductors are described in this report. Helicon propagation experiments in semiconductors were performed and analyzed for the purposes of obtaining cyclotron effective masses of electrons in small-gap semiconductors for which conventional cyclotron resonance was impossible. In addition, the important solid state parameters, the carrier density, the mobility and the dielectric constant of the lattice were also measured by the same techniques. Cyclotron resonance in tellurium was carried out with considerable success in elucidating the valence and conduction band structure of tellurium crystals which were grown in the laboratory. The above experiments gave information about the Fermi surfaces of undeformed or intrinsic materials. In supporting work, the de Haas-van Alphen and Shubnikov-de Haas effects were studied in bismuth for purposes of examining the changes of band structure or band overlap produced by uniaxial stress. Interest in the band structure at points in the Brillouin zone removed from the Fermi surface made it interesting to perform reflectivity experiments in the visible and infrared regions. To support this effort, a unique reflectometer was constructed which has permitted higher sensitivity studies of the reflectivity than has been possible in other published work on the materials investigated, namely, Ge, Hg(1-x)Cd(x)Te, GaAs, as well as Te. Author (TAB)

N70-16079 National Lending Library for Science and Technology, Boston Spa (England).
DISTRIBUTION OF IMPURITIES DURING CRYSTAL GROWTH FROM THE MELT
V. N. Vigdorouich et al 28 Jul. 1969 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), v. 5, Sep. – Oct., 1968 p 89 – 92
(NLL-RRE-Trans-231-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The behavior of Cu, Ag and Ni impurities during the growth process of indium crystals from the melt experimentally studied with different initial impurity concentrations and different crystallization rates. It is shown that the Pfann assumptions are not fulfilled. Deviation from them is greater, the greater the crystallization rate

and the initial concentration. The shape of the actual impurity distribution curves is explained by partial fulfillment of the Pfann and Tiller assumptions. Author

N70-16158# Comitato Nazionale per L'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
STATISTICAL APPROACH TO THE SPIN REFRIGERATOR
V. Montelatici 22 Apr. 1969 26 p refs *Its* Nota Interna No. 443
(LNF-69/28) Avail: CFSTI

A mathematical and qualitative discussion is presented on the proton spin refrigerator. A substance composed by a crystal lattice and by two systems of magnetic moments is considered. The substance is immersed in an external magnetic field of high strength, and is in thermal contact with a heat bath. The spin temperature, chemical potentials, and thermal mixing of two interacting spin systems are described. The relation between the spin lattice relaxation times and the spin temperatures is discussed, and an experiment is described to detect positive, negative, and infinite spin temperatures. Cross relaxation time at the mixing temperature is also considered. N.E.N.

N70-16213# Stanford Research Inst., Menlo Park, Calif.
GROWTH, PROCESSING, AND CHARACTERIZATION OF BETA-SILICON CARBIDE SINGLE CRYSTALS Scientific Report
Arne Rosengreen Aug. 1969 25 p refs
(Contract F19628-67-C-0243)
(AD-694494; AFCRL-69-0372; SR-5) Avail: CFSTI CSCL 20/2

Techniques were developed for fabricating Hall samples for the evaluation of epitaxial layers of beta-silicon carbide. Methods were developed for easy determination of the (111) surface of the beta-silicon carbide substrates. Epitaxial growth on only one side of the substrate was accomplished by gluing the substrate to the pedestal with a sugar solution. Measurements made on an n-type layer deposited on an n-type substrate indicate that the epitaxial layer has much higher resistivity than has been obtained in solution-grown crystals. p-Type substrates were also grown and evaluated. Their impurity concentration was estimated to be in the range 10 to the 20th power -10 to the 21st power/cu cm. The Hall mobility of the holes at room temperature was 4 sq cm/V sec. Author (TAB)

N70-16380*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
MAGNETIC FLUX FLOW AND SUPERCONDUCTOR STABILIZATION Quarterly Report, 1 Oct. – 31 Dec. 1968
Apr. 1969 54 p refs
(NASA Order H-29278A)
(NASA-CR-107544; ORNL-TM-2534) Avail: CFSTI CSCL 20L

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1. CRITICAL CURRENT PEAK EFFECT WITH RESPECT TO TEMPERATURE AND FIELD IN A TYPE 2 SUPERCONDUCTOR D. M. Kroeger p 2–9 (See N70-16381 05-26)

2. THERMAL EQUILIBRIUM STATES OF COMPOUND CONDUCTORS WITH VARIOUS COPPER TO SUPERCONDUCTOR RATIOS W. F. Gauster, J. L. Horton, G. F. Leichsenring, and J. D. Mc Dowell p 10–19 (See N70-16382 05-26)

3. FLUX JUMPS IN BULK TYPE 2 SUPERCONDUCTORS M. S. Lubell p 20–44 refs (See N70-16383 05-26)

4. APPENDIX: STEADY STATE STABILITY OF COMPOSITE SUPERCONDUCTORS W. F. Gauster p 45–49 refs (See N70-16384 05-26)

N70-16381*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
CRITICAL CURRENT PEAK EFFECT WITH RESPECT TO TEMPRATURE AND FIELD IN A TYPE 2 SUPERCONDUCTOR
D. M. Kroeger *In its* Magnetic Flux Flow and Superconductor Stabilization Apr. 1969 p 2–9 (See N70-16380 05-26)
Avail: CFSTI

The results of experiments in which the critical current density of an Nb–5 at. % Ti strip showed a strong peak effect as a function of magnetic field and temperature are discussed. The samples were suspended in a vacuum in thermal but not electrical contact with copper blocks. Curves of the critical current density vs H were obtained for constant temperatures in the 4.5-9 K range, and these show strong peak effects. The V–I characteristics were also determined, and the stability of the flux flow state is discussed. N.E.N.

N70-16382*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
THERMAL EQUILIBRIUM STATES OF COMPOUND CONDUCTORS WITH VARIOUS COPPER TO SUPERCONDUCTOR RATIOS
W. F. Gauster, J. L. Horton, G. F. Leichsenring, and J. D. Mc Dowell *In its* Magnetic Flux Flow and Superconductor Stabilization Apr. 1969 p 10–19 (See N70-16380 05-26)
Avail: CFSTI

A numerical analysis is presented of test results obtained with a compound conductor sample contained in a copper matrix of superconducting Nb–Ti. A linear temperature dependence of the superconductor current was assumed, and the current–voltage characteristics for thermal equilibrium in the current sharing state were calculated. The thermal equilibrium states of compound conductors with various copper to superconductor ratios are discussed. Various cases of multistrand compound conductors with the same area but with various copper to superconductor ratios are considered. It is felt that the maximum nucleate heat transfer limit cannot be reached, an attempt to improve a previous and earlier model by considering the actural heat transfer is not succesful if the superconductor current is assumed equal to the critical current, and there are a variety of possibilities for the conductor stability. N.E.N.

N70-16383*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
FLUX JUMPS IN BULK TYPE 2 SUPERCONDUCTORS
M. S. Lubell *In its* Magnetic Flux Flow and Superconductor Stabilization Apr. 1969 p 20–44 refs (See N70-16380 05-26)
Avail: CFSTI CSCL 20L

Flux jumping in Nb alloys with low Ti concentrations and with 25% Zr was investigated. Expressions are given for the flux jump field. Experiments were performed on thick walled tubes 3.24 cm long, 1.84 cm in diameter, and with 0.44 cm bore, made of Nb alloys with 5%, 10%, and 25% Ti. The current density was too low to obtain any flux jumps at 4.2 K. The Nb–Zr tube was 5.1 cm long, 1.78 cm in diameter, with a 0.19 cm bore. Preliminary results indicate that a limited instability region existed well before a flux jump and grew in frequency and magnitude as the flux jump field was approached. The jumps occurred at approximately 6 kG intervals between 7.08 and 30 kG, and low frequency voltage oscillations were noted just prior to the second and third flux jumps. N.E.N.

N70-16384*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
APPENDIX: STEADY STATE STABILITY OF COMPOSITE SUPERCONDUCTORS
W. F. Gauster *In its* Magnetic Flux Flow and Superconductor Stabilization Apr. 1969 p 45–49 refs (See N70-16380 05-26)
Avail: CFSTI CSCL 20L

A model of the steady state stability is described and the results of a modification are discussed. The model is based on the dependence of the superconductor current on the magnetic field and the superconductor temperature, and assumes a constant heat transfer coefficient. The modification assumes a varying heat transfer coefficient. An I–V curve calculated with the original model gave poor agreement with experimental data, and a curve obtained

with the modified version was even worse. Other efforts yielded satisfactory results when the superconductor current was considered to depend on T, H, and V. It was determined that for currents appreciably larger than the critical current the V-dependence can be neglected, but must be considered when the flux flow resistance is much smaller than the stabilizer resistance. N.E.N.

N70-16406*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE OPTICAL ANALYSIS OF PHOTOEMISSION
Stephen V. Pepper Washington, D.C. Jan. 1970 24 p refs (NASA-TN-D-5610; E-5321) Avail: CFSTI CSCL 20L

An analysis of the role of classical optics in the process of photoemission from thin films is presented. The generation of excited electrons throughout the film is assumed to be proportional to the divergence of the Poynting vector in the film. The film and substrate are allowed uniaxial optical anisotropy with the optic axis normal to the plane of the film. The main results of the analysis, expressions for the reflectance, transmittance, and divergence of the Poynting vector in the film, are valid for all angles of incidence and arbitrary values of the dielectric functions of the initial medium, film, and substrate. Expressions for the quantum yield are obtained with the aid of a simple function that describes the diffusion and escape of the excited electrons. Some applications to photoemission from metals in the vacuum ultraviolet region are discussed. Author

N70-16578# Kernforschungszentrum, Karlsruhe (West Germany).
PROGRESS REPORT ON THE INVESTIGATIONS OF SUPERCONDUCTING STRUCTURES AT KARLSRUHE
H. Schopper *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 755–764 refs (See N70-16548 05-24)
Avail: CFSTI

A brief description of the research on superconducting accelerating structures being done at Karlsruhe is presented. Topics discussed are preparation of superconducting surfaces, measurements and results of Q values, effects at high energy electric fields, optimization of structures for proton acceleration, and superconducting particle separators. NSA

N70-16579# Kernforschungszentrum, Karlsruhe (West Germany).
INVESTIGATION OF ADDITIONAL LOSSES OF SUPERCONDUCTING CAVITIES DUE TO FIELD DEPENDENT EFFECTS AT HIGH LEVELS
W. Kuehy *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 765–770 refs (See N70-16548 05-24)
Avail: CFSTI

The cavity model used, the principle of measurements, and the experimental results of an investigation on additional losses of superconducting cavities due to field dependent effects at high levels are discussed. NSA

N70-16580# Kernforschungszentrum, Karlsruhe (West Germany).
Q-MEASUREMENTS IN SUPERCONDUCTING LEAD CAVITIES AT 800 MHz
P. Flecher, J. Halbritter, R. Hietschold, P. Kneisel, L. List et al *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 770–773 refs (See N70-16548 05-24)
Avail: CFSTI

Q measurements were made for two types of superconducting lead cavities. The first was a cylindrical cavity quoted in the Te-011 mode at 800 MHz and the second was a shorted coaxial line quoted in the TEM-001 mode at 750 MHz. A comparison between the theory and experimental results was also made. NSA

N70-16581# Massachusetts Inst. of Tech., Cambridge.
NON-CRYOGENIC HIGH DUTY CYCLE ELECTRON LINEAR ACCELERATORS
J. Aaimson *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 2 May 1968 p 775–802 refs (See N70-16548 05-24)
Avail: CFSTI

The design characteristics of linear accelerators having high duty factor systems which utilize normal disc loaded traveling wave structures designed to operate over a wide dynamic range of peak rf power to provide narrow energy spectra, low emittance beams of high intensity are discussed. Brief descriptions are presented of the rf system and beam centerline components of the MIT accelerator to further illustrate some of the design problems common to high duty factor machines. NSA

N70-16695 California Univ., Los Angeles.
SHORT-RANGE INTERACTIONS INVOLVING DISLOCATIONS
George Philip Haviland (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-5313

Dislocation-dislocation interactions as well as other dislocation-defect interactions at short ranges cannot be treated using the Volterra-Burgers theory because of the singularity that exists at the center of the dislocations. A new method is proposed that permits the calculation of the interaction energy by using an analytical representation of the dislocation core based on the Peierls model. The present method provides a connection between the atomistic approach to the core structure and the classical elastic continuum approach, namely, the Volterra-Burgers theory. Relying heavily on numerical methods, calculations are made for the stress fields of a modified Peierls edge and screw dislocation, for the interaction energies as well as the interaction forces, of two parallel modified Peierls edge and screw dislocations, for the interaction energy of two modified Peierls dislocation loops, for the energy of dislocation dipoles, and finally for the interaction energy of a dislocation-point defect combination. Dissert. Abstr.

N70-16697 Texas Univ., Austin.
SPIN-LATTICE RELAXATION PROCESSES IN MANGANESE-ZINC SILICOFLUORIDE RELATED TO MAGNETIC FIELD STRENGTH
Larry Ray Adkins (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-6098

This study is concerned with the magnetic field dependence of the spin-lattice relaxation process for the S-state ion Mn(++) in crystalline ZnSiF6-6H2O. The spin-lattice relaxation time measurements for this ion were made at L-band, X-band, and K-band frequencies. Appropriate microwave apparatus was prepared for each frequency band, along with equipment necessary for achieving cryogenic temperatures. Time was measured as a function of temperature from 4.2 K to 77 K at each frequency studied, and the resulting data were compared with existing theoretical interpretations concerning the magnetic field (corresponding to the frequency) dependence of the relaxation time. Dissert. Abstr.

N70-16713*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
MAGNETIC FLUX FLOW AND SUPERCONDUCTOR STABILIZATION Quarterly Report, 1 Jul.–30 Sep. 1968
Nov. 1968 99 p refs Sponsored in part by AEC (NASA Order H-29278A)
(NASA-CR-107548; ORNL-TM-2441) Avail: CFSTI CSCL 20L

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5. FLUX FLOW STUDIES AND STABILITY CRITERIA OF NbTi STRIPS M. S. Lubell and D. M. Kroeger p 10–36 refs (See N70-16714 05-26)

6. STEADY STATE PERFORMANCE OF MULTISTRAND SUPERCONDUCTING COMPOUND CONDUCTORS W. F. Gauster p 37–65 refs (See N70-16715 05-26)

7. HEAT TRANSFER FROM CYLINDRICAL SURFACES TO LIQUID HELIUM I K. R. Efferson p 66–89 refs (See N70-16716 05-33)

N70-16714*# Oak Ridge National Lab., Tenn. Thermonuclear Div.

APPENDIX 1: FLUX FLOW STUDIES AND STABILITY CRITERIA OF NbTi STRIPS

M. S. Lubell and D. M. Kroeger *In its* Magnetic Flux Flow and Superconductor Stabilization Nov. 1968 p 10–36 refs Presented at the Cryog. Eng. Conf., Cleveland, 1968 (See N70-16713 05-26)

Avail: CFSTI

An apparatus is described for measuring critical current as a function of temperature and field. Complete test cycles were performed on bare strips of three NbTi alloys in unrestricted helium flow. Although the samples studied had low critical currents and large surface-to-volume ratios and were overstabilized, the power at take-off was not dictated by the maximum heat flux in nucleate boiling. The magnitude of the take-off power and its anomalous dependence on magnetic field can be explained by means of temperature fluctuations due to local changes in heat transfer and a field dependent minimum propagating current. Analysis of the field dependent recovery power can give the heat flux as a function of temperature for the film boiling regime, which agrees well with conventional heat transfer measurements. R.B.

N70-16715*# Oak Ridge National Lab., Tenn. Thermonuclear Div.

APPENDIX 2: STEADY STATE PERFORMANCE OF MULTISTRAND SUPERCONDUCTING COMPOUND CONDUCTORS

W. F. Gauster *In its* Magnetic Flux Flow and Superconductor Stabilization Nov. 1968 p 37–65 refs Presented at the Appl. Superconductivity Conf., Gatlinburg, Tenn., 1968 (See N70-16713 05-26)

Avail: CFSTI CSCL 20L

A careful numerical analysis of a measured steady state current-voltage characteristic of a superconducting compound conductor is reported. Since the diameter of the superconducting filaments is very small, a uniform temperature inside the conductor is assumed. The actual, non-linear heat transfer from copper to the helium bath is taken into account. Furthermore, it is considered that the flux flow resistance of the superconductor increases from zero to values much greater than the copper resistance. In the absence of flux jumps, the current sharing state should be terminated by a steady state condition which in the presented case occurs before the transition from nucleate to film boiling. The actual "take-off" observed was below the mentioned steady state limit. Author

N70-16720# RAND Corp., Santa Monica, Calif. California Univ., Los Angeles.

MAGNETIC PERMEABILITY ANOMALY IN HEXAGONAL CLOSE PACKED METALS

Frederick Milstein and Lawrence Baylor Robinson Sep. 1969 24 p refs Presented at the Intern. Colloq. of the CNRS on Phys. Properties of Solids under Pressure, Grenoble, France, 8–10 Sep. 1969 Submitted for publication Prepared jointly with Calif. Univ.

(AD-694255; P-4189) Avail: CFSTI CSCL 20/12

Inductance measurements with polycrystalline Gd were found to exhibit an anomalous giant permeability well below the Curie temperature. This giant permeability is evidently related to the anomaly in the weak field magnetization curves of polycrystalline Gd observed by K. P. Belov, who suggested that the anomaly implies a helical spin structure for Gd. It is shown that such an anomaly should occur for a hexagonal, ferromagnetic, polycrystalline material with low basal plane anisotropy (such as Gd) when the direction of easy magnetization departs from the c-axis. If the basal plane anisotropy is neglected, the theoretical weak field permeability is approximately proportional to sin theta, where theta is the angle between the c-axis and the magnetization vector in a representative domain. Good agreement is obtained between the observed permeability and experimental values of sin theta based upon magnetic anisotropy or neutron diffraction measurements of others. Author (TAB)

N70-16766 California Univ., Berkeley.

ANISTROPIC FRICTION BETWEEN ALUMINUM SINGLE CRYSTALS IN ULTRAHIGH VACUUM

Richard Douglas Nelson (Ph.D. Thesis) 1968 217 p

Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-3662

The frictional characteristics of face centered cubic aluminum single crystals sliding on each other were investigated in air and in ultrahigh vacuum with both oxidized and ion bombardment cleaned surfaces. Six crystallographic oreintations were used: two sliding directions on each of three crystallographic planes. Galling friction occurred and in every case the severity of friction depended upon crystallographic orientation. The frictional anisotropy could not be explained on the basis of surface properties as is usually accepted. The determining factor was the arrangement of the crystallographic slip planes in the bulk material. The experimentally observed anisotropy was consistent with a proposed slip-field analysis of the deformations which lead to the formation and growth of a galling particle. For some orientations, the slip planes provide a good fit to the slip-field and enhance both the initiation and growth of galling particles, leading to high friction. Dissert. Abstr.

N70-16816 Cincinnati Univ., Ohio.

TEMPERATURE AND FIELD DEPENDENCE OF FLUX FLOW RESISTIVITY IN TYPE 2 SUPERCONDUCTORS

Carl Joseph Axt (Ph.D. Thesis) 1968 87 p

Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-6328

The d.c. differential flux flow resistivity of type II superconducting foils is studied as a function of magnetic field and temperature in alloys with a range of values of the surface energy parameter, K. Most of the data is obtained on the Pb-Ti system. Some of the results are reported with the In-Bi system. The flux flow resistivity is found to be independent of the critical pinning current and exponential in the field near the bulk upper critical field. Dissert. Abstr.

N70-16826*# Case Western Reserve Univ., Cleveland, Ohio. School of Engineering.

SILICON SURFACE PASSIVATION FOR DEVICES Research Report, 1 Sep. 1968–1 Sep. 1969

Eugene T. Yon 1 Sep. 1969 179 p refs

(Grant NGR-36-003-067)

(NASA-CR-107618) Avail: CFSTI CSCL 20L

Progress in research on gold contamination effects in MOS devices, water contamination in thermal oxide on silicon, interface state measurement by MOS low temperature transient capacitance, and screening device tests is presented. Radiochemical data are given for gold concentrations in interface systems following diffusion, and for the correlation of water and sodium interactions during diffusion in film oxides. Observations of the flat band voltage shift of the differential capacitance versus bias and characteristics of

metal oxide silicon at low temperatures were made to determine density of interface states. Water film conductance measurements, transient differential quench, and low temperature reverse current characterization screening device tests were also performed. J.M.C.

N70-16902# Pennsylvania State Univ., University Park. Dept. of Physics.
ELECTRICAL TRANSPORT PROPERTIES OF THIN BISMUTH FILMS Interim Technical Report
Richard A. Hoffman Oct. 1969 89 p refs
(Contract Nonr-656(34))
(AD-696665; TR-8) Avail: CFSTI CSCL 20/12

Bismuth films with a well-ordered but twinned crystal structure were grown by slow vacuum deposition (100 A/min) onto heated mica substrates (160C) in ultra-high vacuum 5 x 10 to the - 9th power) followed by annealing at 160 C for 1/2 hour. The resistivity and Hall coefficient of these films with thicknesses between 700 and 37,000 A were measured between 1.15 and 300 K while the magnetoresistance coefficient was measured at 1.15, 4.2, 77 and 300 K. It was found that the surface scattering of the charge carriers in these films is not specular, contrary to the findings of other workers. Quantum size effect oscillations were observed in all the transport properties of the thinnest films at low temperatures. TAB

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-15679# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
STORAGE STABILITY OF AVIATION TURBINE FUELS: A RADIOTRACER TECHNIQUE FOR ESTIMATING COMPONENT CONTRIBUTION TO THERMALLY INDUCED DEPOSITS
Marvin L. Whisman, John W. Goetzinger, and Cecil C. Ward Dec. 1969 28 p refs
(BM-RI-7325) Avail: Issuing Activity

A radiotracer technique developed by the Bureau of Mines extends to the parts-per-billion range the sensitivity for determining contributors of deposits formed in stored and thermally stressed jet fuels. The method depends upon measuring radioactivity associated with thermally induced deposits from fuels containing one labeled compound. The technique was applied to 88 test blends, representing 12 fuels and nine carbon-14 labeled fuel constituents or fuel additives, or both. Data from results of these tests are included in this report. With this radiotracer technique, the contribution of fuel components and additives to thermally induced deposits in a variety of fuel environments was estimated before and after storage. Author

N70-15771# Utah Univ., Salt Lake City.
THE CHEMISTRY AND MECHANICS OF COMBUSTION WITH APPLICATION TO ROCKET ENGINE SYSTEMS Annual Report, 1 Sep. 1968 - 31 Aug. 1969
M. L. Williams, A. D. Baer, N. L. Ryan, L. K. Isaacson, and J. D. Seader Sep. 1969 30 p
(Contract F44620-68-C-0022)
(AD-695811; UTEC-TH-69-073; AFOSR-69-2548TR) Avail: CFSTI CSCL 21/9.2

The purpose of this program is to study the interdependence of combustion processes and the physico-mechanical behavior of solid fuel materials within the context of a rocket engine system. It is intended to capitalize upon a quantitative understanding of molecular structure, which affects both the combustion and mechanics behavior, and treat the propellant fuel and associated inert components as a materials system--from processing, to a determination of the constitutive equation as needed to assess structural integrity, and failure under various environmental and loading conditions. Concurrently, the tasks are concerned with propellant as an energy source--from ignition, through burning, gas dynamics inaction with nozzle and insulation components, and consideration of electron noise and radar attenuation in the plume. Six task areas are presently involved in this research. The six areas, not necessarily of equal emphasis, are: Combustion and Transport Mechanisms, Flow and Heat Transfer, Ablation Mechanisms, Radiation Attenuation and Plasma Physics, Mechanics of Solids, Transition to Detonation Mechanisms. Author (TAB)

N70-15869# Atomics International, Canoga Park, Calif.
LARGE RADIOISOTOPE HEAT SOURCE CAPSULE PROGRAM. TOPICAL REPORT NO. 7: CAPSULE FIRE TEST RESULTS
J. M. Harris 29 May 1969 54 p refs
(Contract AT-(29-2)-2338)
(AI-AEC-12841) Avail: CFSTI

A test was performed to establish the behavior of the refractory metal Large Radioisotope Heat Source Capsule in the flame of a solid propellant, such as might be encountered in the event of a launch pad abort. An instrumented capsule was placed on top of a block of Algol IIB solid propellant. Within one minute after propellant ignition the platinum oxidation cladding reached its melting point, exposing the tantalum alloy structural shell directly to the propellant flame and ashes. There was attack to the surface of the capsule by interstitial elements in the flame and air, and erosion from the molten platinum, rhodium, and aluminum. However, the structural shell was not breached and the fuel simulant was completely contained. These established that the LRHS capsule can withstand the potentially severe environment of a launch pad abort fire, remain impermeable to helium and completely contain a radioisotope fuel. Author (NSA)

N70-16218# Institute for Defense Analyses, Arlington, Va.
SIMILITUDES AND LIMITATIONS IN TRANS-CONVENTIONAL PROPULSION SYSTEMS
George C. Szego *In* AGARD Space Power Systems, Pt. 1 Nov. 1969 p 1 - 19 refs (See N70-16217 05-03)
Avail: CFSTI

Methods are discussed for improving rocket performance by increasing the relative exhaust velocity or the specific impulse derived from the substantially unincreasable fraction of the contents devoted to the expellant. Modes of increasing the energy content of propellants or using energy stored elsewhere than in the expellant in order to accelerate it are considered. To optimize a space vehicle more fully, a combined consideration must be made of the total requirements from the earth's surface to destination, for example, a variable thrust program may be combined with the criterion of minimum launching, and the results will depend upon the mission requirements. R.B.

N70-16236# Western Co. of North America, Richardson, Tex. Research Div.
INVESTIGATION OF MODIFIED TURBINE FUELS FOR REDUCTION OF CRASH FIRE HAZARD Final Report
Ken Posey, Jr. May 1969 39 p refs
(Contract FA68NF-269)
(AD-694008; FAA-NA-69-10; FAA-DS-69-1) Avail: CFSTI CSCL 21/4

Fifty-five modified fuels were tested and rated for their ability to reduce aircraft post-crash fires. The candidate fuels were subjected to a seven-part rating scheme in which combustion and physical properties were examined under both static and dynamic conditions. Measurements were made of flash point, rate of vapor

release, burn rate, surface flame propagation rate and fuel spread rate (ignited), as well as fireball size under impact conditions (drop test) and fireball size with sample propelled by a catapult device. Fuels gelled with either alkyl-hydroxybutyramides, amine diisocyanates, Al-2-ethylhexanoate (aluminum octoate) or a styrene-type polymer as well as an emulsified fuel were found to provide marked safety benefits. The alkyl-hydroxybutyramide gels, the amine diisocyonates, and the emulsion had a firm, or stiff, consistency which would present a serious a serious tank feed-down problem in present aircraft. The polymer gel was pourable but contained harmful sodium and required a relatively high polymer concentration, and the polymer was not compatible with the de-icer contained in JP-4. The aluminum octoate gel was selected as the best of the candidate fuels tested. It was pourable, provided marked safety benefits, required only a low concentration (1%), was stable, noncorrosive and was easily prepared. Author (TAB)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-15705*# Harry Diamond Labs., Washington, D.C.
FLUERIC NORMAL SHOCK SENSOR
Allen B. Holmes, Stacy E. Gehman, David Egolf, and Michael Lewellen Apr. 1969 26 p ref
(NASA Order A-1317-A)
(NASA-CR-107688; AD-692292; HDL-TM-69-9) Avail: CFSTI CSCL 21E

A circuit for measuring shock location in the divergent section of a jet-engine inlet diffuser was designed and tested. The circuit consists of 12 bistable sensing elements and a fluid logic network. Control signals to the sensors are obtained from static pressure taps located along the diffuser wall. Fluid logic is employed to prevent erroneous signals from affecting the computed shock position. The circuit was bench-tested over a wide range of pressures to simulate actual operation on an experimental inlet between Mach numbers 1.75 and 3.0. These tests were conducted to establish the static response of the circuit to variations in wall pressure, supply pressure, and ambient pressure. Author (TAB)

N70-15885# Naval Ordnance Lab., White Oak, Md.
A TIME-DEPENDENT ANALYSIS FOR QUASI-ONE-DIMENSIONAL NOZZLE FLOWS WITH VIBRATIONAL AND CHEMICAL NONEQUILIBRIUM Final Report
John D. Anderson, Jr. May 1969 58 p refs
(AD-693987; Noltr-69-52) Avail: CFSTI CSCL 21/8

A new technique is presented for the numerical solution of quasi-one-dimensional, vibrational and chemical nonequilibrium nozzle flows including nonequilibrium conditions both upstream and downstream of the throat. This new technique is a time-dependent analysis which entails the explicite finite-difference solution of the quasi-one-dimensional unsteady flow equations in steps of time, starting with assumed initial distributions throughout the nozzle. The steady-state solution is approached at large values of time. A virtue of the present time-dependent analysis is its simplicity, which prevails from its initial physical formulation to the successful receipt of numerical results. Also, the present solution yields the transient as well as the steady-state nonequilibrium nozzle flows. To exemplify the present analysis, results are given for several cases of vibrational and chemical nonequilibrium expansions through nozzles. Author (TAB)

N70-15992*# Gulton Industries, Inc., Hawthorne, Calif. Engineered Magnetics Div.
APPLIED RESEARCH AND FEASIBILITY STUDIES, EXPERIMENTAL INVESTIGATIONS AND CONCEPTUAL OR PRELIMINARY DESIGN ENGINEERING APPLICABLE TO INVERTERS FOR MOTORS PROGRAM Final Report, Jun. 1967–Jan. 1968
D. B. Irvine 27 Jan. 1969 87 p
(Contract NAS8-20832)
(NASA-CR-102388; Rept-2370) Avail: CFSTI CSCL 21E

An inverter–motor system was developed and used to obtain information relating to efficiency, torque versus speed, slip control, current limiting, and design and operating characteristics of inverters and motors. The inverter–motor system consisted of a 1/7 horsepower rated ac induction type motor operated in conjunction with an inverter breadboard having a quasi-square wave output. The motor was fabricated and tested in accordance with design requirements. Author

N70-16082# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF PERFORMANCE PARAMETERS OF A DUAL DISCHARGE RADIAL TURBINE
David Daniel Williams (M.S. Thesis) Dec. 1968 156 p refs
(AD-694151) Avail: CFSTI CSCL 21/5

The study was conducted to establish the performance parameters of a radial inflow, dual discharge turbine and to determine the effect of variations in axial clearance on these parameters. The representative stream surface is taken at the outer discharge radius instead of at a computed mass-average discharge radius, as was done previously. This technique results in considerably simplified computations and in better correlation of the rotor loss parameters. Tests were conducted at axial clearances from 0.015 to 0.081 inches and at total-to-static pressure ratios from 1.2 to 1.7 for each clearance. Author (TAB)

N70-16116# Messerschmitt-Boelkow G.m.b.H., Munich (West Germany). Space Div.
ELDO FEASIBILITY STUDY NO. 13.3: SOLAR- AND NUCLEAR-ELECTRIC PROPULSION STAGES FOR TRANSFER INTO A TWENTY-HOUR ORBIT
Helmut Schweig, Erich Arbeitlang, H. Brodersen, K. Petzer, P. Kleber et al Mar. 1969 228 p refs Supported partly by DFVLR Res. Center, Brunswick
(Rept-DSP-6-427-0) Avail: CFSTI

This report compares chemical and electric propulsion for transferring commercial communication satellites, especially direct TV-transmission satellites, into synchronous orbits. Electrical propulsion, in combination with nuclear and solar power supplies is examined in the light of technical possibilities of the near future. Payload and orbital calculations were made to compare the payload of an electrical propulsion stage with chemical transfer. Then payload combinations were formed to show the range of power which can be installed in a twenty-four hour orbit depending on the different power sources. For these combinations a series of designs were established, discussed, and compared with the values assumed in the overall payload calculations. A time and cost plan for the main versions was established and discussed, and a final comparison was made. ESRO

N70-16206# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.
RESEARCH ON FAILURE INDICATOR SYSTEM Interim Report, 1 Aug. 1968–31 Jul. 1969
Bob V. Markevitch and Gordon R. Knight 1 Aug. 1969 62 p refs
(Contract N00014-67-C-0401)
(AD-694544; RR-69-13; IR-2) Avail: CFSTI CSCL 21/5

Recording and frequency analysis of vibration data by means of coherent optical data processing techniques is described with special emphasis on the detection or diagnosis of failures in

rotating mechanisms. Vibration signals from gas turbine engines were analysed and compressor, turbine, bearing, and gear components were identified in the optical spectrum. Author (TAB)

N70-16221# Advisory Group for Aerospace Research and Development, Paris (France).
MECHANICAL HEAT ENGINES FOR SPACE POWER SYSTEMS
Eugene B. Zwick *In its* Space Power Systems, Pt. 1 Nov. 1969 p 303–348 refs (See N70-16217 05-03)
Avail: CFSTI

Mechanical Heat Engines represent an important class of energy conversion devices for power generation in space. Power levels ranging from kilowatts to megawatts can in principle be supplied by mechanical systems having high thermal efficiency and low total system weight. The use of mechanical systems is particularly attractive because of a solid foundation of thermodynamic principles and component development. Only materials problems are a significant obstacle in the development of mechanical power systems for space use. The heat engine concepts are reviewed which are of significance for space applications. A thermodynamic consideration is given to establish basic cycle characteristics and the relative importance of various factors such as temperature and component efficiency on cycle performance. A number of cycles are examined in terms of the problem of optimizing a power system for use with a space vehicle. R.B.

N70-16223# Advisory Group for Aerospace Research and Development, Paris (France).
TURBOMACHINERY FOR SPACE POWER
Eugene B. Zwick *In its* Space Power Systems, Pt. 2 Nov. 1969 p 351–369 refs (See N70-16222 05-03)
Avail: CFSTI

Recent advances in turbomachine technology for missile and space power applications have far reaching implications for all power system designs. Low specific machine performance has been greatly improved. In addition, new optimized turbomachinery design data is being derived. Machine performance and design data can now be found on specific speed–specific diameter diagrams. These data are in a form which is immediately usable by systems analysts. No specialized turbomachinery background knowledge is required. The preliminary design of a 20 kW Biphenyl Rankine cycle power plant is used to illustrate the application of the specific speed–specific diameter concepts and charts. Author

N70-16231*# Colorado State Univ., Fort Collins. Engineering Research Center.
ADVANCED ELECTRIC PROPULSION RESEARCH Final Report, 1 Jul. – 31 Dec. 1968
William R. Mickelsen May 1969 101 p refs
(Grant NGR-06-002-032)
(NASA-CR-107484; Rept-8) Avail: CFSTI CSCL 21H

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3. PERFORMANCE MAPPING OF 20-CM HOLLOW-CATHODE MERCURY ION THRUSTER D. Fitzgerald and R. Vahrenkamp 36 p refs (See N70-16234 05-28)

N70-16232*# Colorado State Univ., Fort Collins.
THEORETICAL ANALYSES OF ELECTROTHERMAL THRUSTERS WITH SUPERSONIC HEAT ADDITION
Harry I. Leon and William R. Mickelsen *In its* Advanced Elec. Propulsion Res. May 1969 22 p refs Presented at the AIAA 7th Elec. Propulsion Conf., Williamsburg, Virginia, 3–5 Mar. 1969 (See N70-16231 05-28)
Avail: CFSTI

Theoretical performance analyses are presented for an electrothermal thrustor using lithium propellant with a combination of radioisotope and electrical energy sources. This thrustor concept allows the lithium propellant to condense in the nozzle and uses the latent heat of vaporization for increasing the exit velocity. Specific impulses of greater than 500 seconds are predicted with plenum temperatures below 2250 K and with electric power/thrust ratios of less than 3 watt/mlb. Author

N70-16233*# Colorado State Univ., Fort Collins.
ANALYSIS OF JUPITER FLY-BY MISSION WITH ELECTRIC PROPULSION
William R. Mickelsen *In its* Advanced Elec. Propulsion Res. May 1969 40 p refs (See N70-16231 05-28)
Avail: CFSTI

Based on the characteristic-length method of analysis, results are reported for the following mission profile factors: boost to hyperbolic excess velocity with SLV-3X/Centaur/Burner 2 (2338); 600-day heliocentric transfer to Jupiter; initial spacecraft weight after boost to hyperbolic velocity; on-board RTG with baseline power of 150 electric watts; hotel load of 50 watts during electric thrusting periods; 100 watts of free power for electric thrustor system from baseline RTG; additional RTG units added as needed for electric propulsion; and usable payload. Electric thrustor system characteristics are presented in graphical form. It is pointed out that the results must be used only as rough indications of trends, and for specifying values of input parameters for more exact trajectory and mission calculations. Author

N70-16234*# Colorado State Univ., Fort Collins.
PERFORMANCE MAPPING OF 20-CM HOLLOW-CATHODE MERCURY ION THRUSTER
Dennis Fitzgerald and Richard Vahrenkamp *In its* Advanced Elec. Propulsion Res. May 1969 36 p refs (See N70-16231 05-8)
Avail: CFSTI

Preparations for experiments on a 20-centimeter mercury electron-bombardment thrustor and present status of the facility are described. A detailed explanation of the procedure for starting and running the thrustor with comments on typical experimental problems which may be encountered is included. Tables of experimental data and results are given. Author

N70-16240*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF SOLAR-ELECTRIC PROPULSION SYSTEMS FOR THE SYNCHRONOUS EQUATORIAL SATELLITE-RAISING MISSION
Frank J. Hrach Washington Jan. 1970 27 p refs
(NASA-TM-X-1936; E-5254) Avail: CFSTI CSCL 21C

A comparison among five solar electric propulsion systems is made for the mission of raising a direct-broadcast television satellite from a subsynchronous earth orbit to a synchronous equatorial orbit. The electric propulsion systems considered all use the solar electric power provided by the satellite but use different thrusters. The electric power and payload mass of the satellite are assumed to be specified. The electric propulsion system is used in combination with a hypothetical launch vehicle in the Atlas-Centaur weight class, a vehicle which is unable to deliver the specified payload mass to the final orbit, even with the help of an additional chemical upper stage. Author

N70-16344# LTV Aerospace Corp., Dallas Tex. Vought Aeronautics Div.
DEVELOPMENT OF A TURBINE ENGINE INLET DEVICE FOR PROTECTION AGAINST BIRD INGESTION Final Report
J. M. Metcalf Jul. 1969 153 p refs Prepared for Dept. of Transportation
(Contract FA-67-WA-1682)
(AD-694551; FAA-DS-69-9) Avail: CFSTI CSCL 21/5

Studies were made to determine and evaluate a number of concepts for protecting turbine engines from damage as a result of bird ingestion. A variety of concepts are reviewed ranging from incorporation of bird tolerant engine designs to installation of deflector grills inside or in front of the engine inlet duct. Descriptive comments are presented for each of the concepts studied. Static load/deflection tests were performed with bird specimens to evaluate grill bar spacing strength requirements for use in later tests. Bird specimens were impacted on a bare grill at 15, 30, and 45 deg inclination to the bird path. A simulated installed protective grill was then fabricated and subjected to bird impacts. Empirical relationships for the load developed on the grill are developed, based upon bird weight, impact velocity, and grill inclination angle. Using the same grill design, tests were performed to evaluate the probable engine power losses associated with incorporation of the device into an airplane inlet duct. Subsequently, a flight test article was developed and submitted for further testing. Results indicate that incorporation of a protective device is feasible for any turbine engine powered aircraft, but that further work is required to determine the most satisfactory means for protecting a specific engine installation. Author (TAB)

N70-16369*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GASEOUS-HELIUM REQUIREMENTS FOR THE DISCHARGE OF LIQUID HYDROGEN FROM A 1.52-METER- (5-FT-) DIAMETER SPHERICAL TANK
Robert J. Stochl, Joseph E. Maloy, Phillip A. Masters, and Richard L. De Witt Washington Jan. 1970 63 p refs
(NASA-TN-D-5621; E-4965) Avail: CFSTI CSCL 21H

An experimental investigation was conducted to determine the effects of various physical parameters on the pressurant gas (gaseous helium) requirements during the pressurization and expulsion of liquid hydrogen from a 1.52-meter- (5-ft-) diameter spherical tank. The experimental results were compared with results predicted by a previously developed analytical program which was revised and extended for this investigation. Tests were conducted for a range of liquid outflow rates, pressurizing rates, and initial ullage volumes at a nominal operating pressure. The experimental results show that the inlet gas temperature has a strong influence on the actual pressurant gas requirements. There is an average decrease in pressurant gas requirements of 1.3 percent for a 10 K (18 R) increase in inlet gas temperature. The analytical program was able to predict the actual pressurant requirements to within a maximum error of 11.5 percent for all cases. Author

N70-16723*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROGEN CAVITATION PERFORMANCE OF 80.6 DEG HELICAL INDUCER MOUNTED IN LINE WITH STATIONARY CENTERBODY
Phillip R. Meng and Royce D. Moore Washington Jan. 1970 19 p refs
(NASA-TM-X-1935; E-5243) Avail: CFSTI CSCL 21H

The performance of an 80.6 deg helical inducer mounted in an inlet line with a stationary centerbody (inlet annulus) was determined in hydrogen over a temperature range of 31.1 to 41.2 R (17.3 to 22.9 K) and a flow coefficient range of 0.08 to 0.12 at 25,000 and 30,000 rpm. The tank net positive suction head NPSH requirement for the inducer in the annulus configuration was less than that required for the same inducer in a line-mounted configuration, but it was greater than that required for a closely coupled configuration. The inducer NPSH requirement increased with increasing flow coefficient and rotative speed and decreased with increasing hydrogen temperature. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-15584# Bergen Univ. (Norway). Dept. of Physics.
X-RAY AND PARTICLE RADIATION AT HIGH ALTITUDES IN THE AURORAL ZONE Final Scientific Report 1 Apr. 1965 – 31 Mar. 1969
Harald Trefall 30 Jun. 1969 57 p refs
(Contract AF 61(052)-869)
(AD-694587; AFOSR-69-2471TR) Avail: CFSTI CSCL 4/1

A summary is given of balloon recordings performed from stations in Northern Norway, from 1965 to 1968, of auroral bremsstrahlung X-ray events produced by electron precipitation into the upper atmosphere in the auroral zone. The morphology and dynamics of such events have been studied by means of multiple balloon flights. The character of the X-ray events has been found to depend very much on the local time at which they are recorded. It appears as if acceleration and precipitation of electrons start in the midnight sector, and spread very rapidly eastward along the auroral oval. Temporarily trapped electrons then seem to drift out of the oval, and give rise to further precipitation events along the statistical auroral zone. Author (TAB)

N70-15614*# California Univ., Los Angeles. Dept. of Physics.
ELECTRON PRECIPITATION PULSATIONS
F. V. Coroniti and C. F. Kennel Apr. 1969 36 p refs
(Grant NGR-05-007-190; Contracts AT(11-1)-34; Nonr-4758(01); Grant NSF GP-6817)
(NASA-CR-107689; AD-691744; R-48) Avail: CFSTI CSCL 04A

When high frequency wave turbulence is present, low frequency micropulsations can strongly modulate the high frequency wave amplitudes, leading to finite amplitude pulsations in the loss rate of energetic electrons from the magnetosphere. An extremely idealized model suggests that the precipitation modulation depends exponentially on the micropulsation amplitude, when the micropulsation period is less than the electron precipitation lifetime. Author (TAB)

N70-15678*# Stanford Univ., Calif. Radioscience Lab.
MAGNETIC RADIATION OBSERVED BY OGO-1 AND OGO-3 BROADBAND VLF RECEIVERS
W. J. Burtis Aug. 1969 63 p refs
(Contract NAS5-2131; Grant NGR-05-020-288)
(NASA-CR-107653; SU-SEL-69-019; TR-3438-1) Avail: CFSTI CSCL 04A

A continuing study of the properties of VLF emissions, using observations from the OGO satellites as well as from ground stations, is presented. It is concerned specifically with radiation observed by the broadband VLF receivers onboard OGO 1 and OGO 3, primarily during 1966. Three distinct classes of emissions are defined and illustrated: banded chorus, banded hiss, and low-frequency noise. The occurrence of radiation in each class is investigated as a function of magnetic shell, dipole latitude, local time, and magnetic activity. The relation of this radiation to VLF emissions observed on the ground and in the topside ionosphere is discussed. Energies are calculated for gyroresonant electrons which may generate banded chorus. The amplitude of banded chorus radiation is estimated and rise and fall times of discrete emissions are illustrated. Author

N70-15689# Minnesota Univ., Minneapolis. Cosmic Ray Group.
THE EFFECTS OF SOLAR MODULATION ON THE ENERGY SPECTRUM OF HEAVY COSMIC RAY NUCLEI Technical Report
T. F. Cleghorn, P. S. Freier, and C. J. Waddington Aug. 1969

12 p refs Presented at the Eleventh Intern. Conf. on Cosmic Rays, Budapest, 1969
(Contract NONR-710(60))
(AD-694461; CR-142; Conf-125) Avail: CFSTI CSCL 4/1

It is planned to determine the form of the energy spectrum at low energies in order to study the effects of solar modulation. Provisional results of relatively low statistical weight are reported here. Author (TAB)

N70-15877*# California Univ., Los Angeles. Dept. of Physics.
AURORAL MICROPULSATION INSTABILITY
F. V. Coroniti and C. F. Kennel May 1969 50 p refs
(Grant NGR-05-007-190; Contracts Nonr-4756(01); AT(11-1)-34; Grant NSF GP-6817)
(NASA-CR-107683; AD-691745; R-49) Avail: CFSTI CSCL 04A

The paper describes a drift instability of Alfven waves driven by the sharp electron thermal gradient at the inner edge of the electron plasma sheet. The analysis predicts a localized instability with wavelengths perpendicular to the magnetic field comparable with an ion cyclotron radius and parallel wavelengths comparable with the length of field lines. The fastest growing wave should have an approximate 10 second period, consistent with observations of Pi 1 micropulsations observed during substorms. Author (TAB)

N70-16054# Harvard Radio Astronomy Station, Fort Davis, Tex.
STUDY OF THE RADIO FREQUENCY SPECTRUM OF THE SUN Final Report, 1 Jan. 1966 – 31 Mar. 1969
Alan Maxwell Apr. 1969 15 p refs
(Contract AF 19(628)-5744)
(AD-694105; AFCRL-69-0310) Avail: CFSTI CSCL 3/2

This document reports on research on radio bursts from the sun. The following subjects are discussed: radio interference at Fort Davis, Texas; new electronics equipment and receivers at the Harvard Radio Astronomy Station at Fort Davis; solar radio observations and theoretical work; and research on the nature of solar activity. Also included is a list, with abstracts, of relevant articles published as a result of the contract. TAB

N70-16087# Bern Univ. (Switzerland). Physical Inst.
APOLLO 11 SOLAR WIND COMPOSITION EXPERIMENT: FIRST RESULTS
F. Buehler, P. Eberhardt, J. Geiss, J. Meister, and P. Signer (Eidgenossiche Technische Hochschule, Zurich) 14 Nov. 1969 14 p refs Submitted for publication
Avail: CFSTI

The He–4 solar wind flux during the Apollo 11 lunar surface excursion was determined. The solar wind direction and energy are essentially not perturbed by the moon. Evidence for a lunar solar wind albedo was found. Author

N70-16228# Advisory Group for Aerospace Research and Development, Paris (France).
PHOTOVOLTAIC DEVICES AND SYSTEMS
M. Rodot (CNRS, Eudon, France) and H. Daspet (CNES, Bretigny-sur-Orge, France) *In its* Space Power Systems, Pt. 2 Nov. 1969 p 503–602 refs (See N70-16222 05-03)
Avail: CFSTI

A solar photocell is defined as a device in which solar energy is absorbed and converted into potential energy of an electron gas, and this electron gas, drifting through a potential barrier, is the active fluid of a current generator. The two tasks of absorption and collection of photoelectrons can be filled in one and the same device, using an adequate semiconductor as the absorber and an adequate physical discontinuity between two solid materials, one of which is the absorber, as the potential barrier. The well-known theory of the silicon cell is summarized and the factors affecting the conversion efficiency of the cell are discussed. A photovoltaic system is an assembly of elementary photocells, each of small surface area in comparison to the total surface of the system, capable of converting the incident solar energy into electrical energy. Several problems are analyzed which arise from the conception and realization of the solar array capable of producing energy in given conditions of lighting, temperature, and space environment. R.B.

N70-16252# Academy of Sciences (USSR), Moscow. Inst. of Geochemistry and Analytical Chemistry.
EFFECTS OF NUCLEAR REACTIONS IN STONY METEORITES
A. K. Lavrukhina *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 3–15 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

Rates of formation for different cosmogenic isotopes were studied as a function of chemical composition in meteorites. Experimental data obtained on proton irradiated iron and aluminum targets established the major components of stony meteorites as products of iron spallation and aluminum nuclei. Formation rates of individual cosmogenic isotopes were estimated by their excitation functions for the entire energy spectrum of primary cosmic radiation and by considering the values for isotope production cross sections from various elements. A comparison of calculated and experimental contents of stable cosmogenic isotopes Ne, A, K, and Sc in a chondrite is presented. G.G.

N70-16347# Danish Space Research Inst., Lyngby.
ON THE SUITABILITY OF CERENKOV COUNTERS FOR ANALYSING THE CHARGE COMPOSITION OF THE PRIMARY COSMIC RADIATION
B. Dayton, M. Lund, and T. Risbo [1969] 27 p refs
Avail: CFSTI

Using Cerenkov detectors it is possible, in principle, to carry out an analysis, element by element, of the chemical composition of energetic nuclei in the primary cosmic radiation, maintaining the same degree of resolution throughout the atomic table. The obtainable resolution is limited by statistical fluctuations, provided that systematic errors are kept sufficiently low. The statistical fluctuations can be studied experimentally using single charged particles. Accelerator measurements were made with a cosmic ray telescope, and its limiting charge resolution capability was evaluated. Author (ESRO)

N70-16721*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
COSMIC RAYS AND THE TERRESTRIAL ATMOSPHERE [KOSMICHESKIYE LUCHI I ZEMNAYA ATOMSFERA]
L. I. Miroshnichenko Washington NASA Jan. 1970 20 p refs Transl. into ENGLISH from Prioroda (Moscow), no. 5, 1969 p 18–29
(Contract NASw-1692)
(NASA-TT-F-12785) Avail: CFSTI CSCL 04A

A general description of the effects of cosmic rays on the terrestrial atmosphere and vice versa is presented. The relationship of cosmic radiation to latitude is examined, with the intensity of the former found to increase toward the poles. The barometric effect, the influence of atmospheric temperature, interference with shortwave radio communication, and the relationship of cosmic weather to terrestrial weather conditions are discussed. A detailed description of the causes and effects of cascade showers is presented. Author

N70-16735 Colorado State Univ., Fort Collins.
ANISOTROPY IN REFLECTED SOLAR RADIATION
Vincent Victor Salomonson (Ph.D. Thesis) 1968 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-5492

The nature of the reflection process for several specific surfaces was observed in detail and in the case of clouds it is shown that the reflection of solar radiation is accomplished by several processes which interact with one another to produce the observed directional reflectance distributions. The first portion of

the study utilized an aircraft-mounted satellite radiometer to observe the reflected radiances over stratus clouds, white sand, snow, a dry desert lake bed, a grassland-sod surface, a swampy-dense vegetation surface, and water. The second portion of the study involved the utilization of existing scattering theory to numerically examine the influence of droplet size distribution and droplet concentrations on single scattering results representative of that occurring in the clouds over which the observations of reflected solar radiation were taken. This portion of the study also compared theoretical results involving multiple scattering with the results actually observed over stratus clouds. Dissert. Abstr.

N70-16786*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
FURTHER COMMENTS CONCERNING LOW-ENERGY CHARGED PARTICLE DISTRIBUTIONS WITHIN THE EARTH'S MAGNETOSPHERE AND ITS ENVIRONS
L. A. Frank Jul. 1969 34 p refs Presented at the Summer Advanced Study Inst., Earth's Particles and Fields, Santa Barbara, Calif., 4-15 Aug. 1969
(Contracts NAS5-2054; NAS5-9074; Grant NsG-233-62; Contract NONR-1509(06))
(NASA-CR-107747; Rept-69-42) Avail: CFSTI CSCL 04A

Several recent observations of the distributions of low-energy charged particles within the earth's magnetosphere and its environs are examined for evidences of source (acceleration) mechanisms. Proton intensities in the outer radiation zone and plasma sheet are concentrated upon since this population forms the largest charged-particle energy reservoir in the magnetospheric system. To date no source mechanism for these proton intensities with broad differential energy spectrums (i.e., of the plasma sheet and the storm - time and quiescent ring currents) has been clearly delineated. It is suggested herein that at least the storm - time ring current protons are of solar origin and are convected into the magnetotail under the influence of magnetospheric electrostatic fields or via a diffusion process driven by fluctuating magnetic and/or electric fields. Author

N70-16901 National Lending Library for Science and Technology, Boston Spa (England).
ON POSSIBLE CAUSES OF THE ATTENUATION OF DIRECT SOLAR RADIATION
I. I. Borzenkova [1969] 16 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 233, 1968 p 38–44
(NLL-M-7746-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Fluctuations in the influx of direct solar radiation may have a substantial effect on the variation of the climate of the planet as a whole. The author considers the possible causes of the attenuation of direct solar radiation. Using literary data, there is the possibility that the change in direct solar radiation is due to fluctuations in the solar constant and shows that the probability of such fluctuations is very small. The attenuation of direct solar radiation by water vapour and dust is considered. For 1956-64 monthly mean values of absorption of direct solar radiation are by water vapour and dust in the case of a clear sky are calculated. Exaggerated values of radiation absorbed by dust in 1964 are noted and related to the eruption of the volcanoes AGUNG and BATUR in 1963. On the basis of these preliminary calcualtions it is supposed that volcanic activity affects both the transmissivity of the atmosphere and the influx of direct solar radiation as a whole to the planet. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-15623*# Exotech, Inc., Washington, D.C. Systems Research Div.
SEVERE PLANETARY ENVIRONMENTS AND THEIR IMPLICATIONS ON TECHNOLOGY FOR FUTURE SPACECRAFT MISSIONS
Aug. 1969 129 p refs
(Contract NASw-1744)
(NASA-CR-107616) Avail: CFSTI CSCL 03B

Existing and evolving models of planetary environments, and of planetary missions currently receiving NASA consideration are reviewed. Current and developing applicable technology is evaluated in terms of providing systems to operate successfully within the hostile planetary environments. Ongoing research intended to close indicated technology gaps is summarized, and recommendations are made for further efforts needed to develop hardware for advanced planetary exploration. Author

N70-15664*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY MAGNETIC FIELD MEASURED BY PIONEER 8 DURING THE 25 FEBRUARY 1969 EVENT
N. F. Ness, F. Mariani (Rome Univ.), and B. Bavassano (Rome Univ.) Nov. 1969 17 p refs Presented at 3rd ESLAB/ESRIN Symp. on Intercorrelated Satellite Observations Related to Solar Events, Sep. 1969
(NASA-TM-X-63790; X-616-69-525) Avail: CFSTI CSCL 04A

The spacecraft was injected into a solar orbit on December 13, 1967. During the time interval of the event, the sun to Pioneer line was pointing 23 deg east of the sun-earth line. The heliocentric distance of the probe was 1.52 × 10 to the 8th power km, i.e. slightly larger than the corresponding sun-earth distance of 1.48 × 10 to the 8th power km. Magnetic measurements were made by a single sensor mounted at an angle of 54 deg 45 min with respect to the spin axis of the probe. Vector components were then obtained by three consecutive measurements at 120 deg intervals from each other during the rotation of the spacecraft. Observations on Pioneer 8 suggest the passage of two fast interplanetary shocks during the event. The lack of information on the solar plasma on board the same spacecraft prevents complete determination of the physical properties of the shocks. The estimated average velocities of the shocks appear quite high, although comparable to those found earlier. R. B.

N70-15619# California Univ., Los Angeles. Dept. of Astronomy.
HIGH PRECISION GEOCENTRIC AND INTERPLANETARY ORBITS Final Report, 1 Oct. 1966 – 31 Dec. 1968
21 Aug. 1969 5 p refs
(Grant AF-AFOSR-241-67)
(AD-694080; AFOSR-69-2262TR) Avail: CFSTI CSCL 3/1

The report is a summary of work accomplished in the observation of planetary trajectories and planetary satellite trajectories. TAB

N70-15648# Lund Observatory (Sweden).
INVESTIGATIONS OF A REGION IN MONOCEROS. PART 4: SPACE DENSITIES OF STARS AND INTERSTELLAR EXTINCTION; CATALOGUE
Bengt Karlsson 1969 99 p refs
(Rept-1) Avail: CFSTI

Space densities of B, A and F type stars are derived from objective prism spectra for a Monoceros region. NGC 2264 is situated within the region. The decrease of F stars with distance is found also here. The present results for stars of spectral type about B5 combined with those of adjacent regions yield a structure agreeing with the shape of the Orion arm in this section of the sky. The interstellar extinction is found to take place mainly between 600 and 1000 parsecs. There are indications that the extinction increases stepwise. A study shows that a two-dimensional classification will be possible for early type stars, though in the present case there are too few standard stars to permit a complete calibration. Author

N70-15649# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
APPLICATION OF A STATISTICAL SURFACE MODEL TO PLANETARY RADAR ASTRONOMY Technical Report
Allan H. Marcus Mar. 1969 25 p refs
(Contract Nonr-4010(09))
(AD-695450; TR-112) Avail: CFSTI CSCL 3/2

A statistical model of the distribution of slopes and elevations on a cratered planetary surface is applied to scattering of radio waves by the Moon and Venus. It is found that the quasi-specular component of backscattered power can be fit by any symmetric stable distribution for elevation differences whose characteristic exponent is between 1 and 2 (crater diameter population index between 2 and 3). However, the lack of dependence on wavelength of the roughness parameter for decimeter and meter wavelengths suggests that surface elevation differences have nearly a Cauchy distribution, not a Gaussian distribution. Author (TAB)

N70-15677*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
INVESTIGATION OF SYNCHRONOUS SATELLITES FOR GEODESY Quarterly Progress Report
C. B. Winn 1969 24 p
(Grant NGR-06-002-085)
(NASA-CR-107629) Avail: CFSTI CSCL 22C

Satellite experiments were developed to measure continental drift and Chandler wobble. Efforts were also made to develop orbit determination programs employing synchronous satellites in the tracking network, and to determine the least number of subsynchronous satellites that will provide continuous coverage of a given region on the ground. Brief discussions of the results obtained are presented. Author

N70-15691*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Space Sciences Dept.
STUDY OF DUST DEVILS AS RELATED TO THE MARTIAN YELLOW CLOUDS, VOLUME 1 Final Report, 1 Jun. 1967–5 Dec. 1968
J. A. Ryan Jan. 1969 121 p refs
(Contract NASw-1620)
(NASA-CR-107676; DAC-63098-Vol-1) Avail: CFSTI CSCL 03B

This study determines whether dust devils could occur on Mars, and be responsible for the observed yellow clouds. Emphasis was given to field studies of dust devils since relatively few good data were available concerning their structure and the conditions under which they form. Field data were obtained in the Mojave Desert of Southern California. Quantities measured were temperature as a function of height and time, background wind velocity and direction, atmospheric vorticity, wind velocities inside dust devils, and dust devil diameter, sense of rotation, height, location, and time of occurrence. Sufficient data were obtained to allow a quantitative dust devil model to be formulated. A computer program was formulated, which predicts the possible temperature profiles in the lowermost Martian atmosphere. Utilizing these profiles and the physical dust devil model, it is found that dust devils should occur on Mars and could be responsible for the yellow clouds. Author

N70-15692*# McDonnell-Douglas Astronautics Co., Newport Beach, Calif. Space Sciences Dept.
STUDY OF DUST DEVILS AS RELATED TO THE MARTIAN YELLOW CLOUDS. VOLUME 2: BASIC DATA Appendix to Final Report
J. A. Ryan Jan. 1969 244 p
(Contract NASw-1620)
(NASA-CR-107677; DAC-63112-Vol-2) Avail: CFSTI CSCL 03B
For abstract see N70-15691.

N70-15708*# Auburn Univ., Ala. Dept. of Mathematics.
ON PERIODIC SOLUTIONS OF AUTONOMOUS HAMILTONIAN SYSTEMS Quarterly Report, 1 Apr.–1 Oct. 1969
Neil Phillibar 25 Oct. 1969 40 p refs
(Grant NGR-01-003-036)
(NASA-CR-107624) Avail: CFSTI CSCL 03C

Investigations of periodic solutions near an equilibrium point for an autonomous differential system (i.e., the differential equations do not explicitly contain time as an independent variable) are of special interest to the mathematician working in the field of dynamical astronomy. Lagrange, for example, established the existence of certain periodic motions about the equilibrium points (called the Lagrangian points) of the equilateral-triangle solution of the restricted three-body problem. The actual existence of periodic motions of this type was verified with the discovery that the Trojan asteriods have periodic orbits about the Lagrangian points of the Jupiter–Sun system. In 1956, Siegel wrote a tract on celestial mechanics in which he developed a criterion for establishing the existence of periodic solutions of autonomous Hamiltonian systems near an equilibrium point. Author

N70-15712# Lockheed Missiles and Space Co., Sunnyvale, Calif.
METEOROLOGICAL INVESTIGATION ON THE LUNAR SURFACE
K. Ia. Kondrat'ev et al [1969] 18 p refs Transl. into ENGLISH of the book "Problemy Fiziki Atmosfery" Russia, no. 6, 1968 p 3–21
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

A portable experimental station consisting of a pyranometer and a balancometer is proposed for lunar radiation balance measurements. A resistance thermometer would be included for lunar surface temperature measurements. Lack of atmosphere and variable temperature effects on these instruments are evaluated. Solar radiation flux, albedo, emissivity, and regional temperature measurements are recommended for determining lunar surface characteristics. Experimental and theoretical results yield estimates of the radiation balance as well as the temporal and spatial distribution. Approximate results are obtained on the radiation balance distribution over the moon's surface. Numerous additional computations on the extreme and median optical and physical parameters of the lunar surface are needed for more thorough deductions. J.A.M.

N70-15720*# Texas Univ., Austin. Applied Mechanics Research Lab.
A DISCUSSION OF TWO GENERAL PERTURBATIONS METHODS AND OF THEIR APPLICATION TO ARTIFICIAL SATELLITE THEORY
Claude Hildebrand, Jr. Jun. 1969 144 p refs
(Grant NGR-44-012-046)
(NASA-CR-107679; TR-1004) Avail: CFSTI CSCL 22C

This thesis is concerned with the application of two general perturbations techniques to the problem of obtaining an analytical description of the motion of an artificial satellite of the Earth. The techniques (von Zeipel's method and a method of successive approximations employed by Kaula in the development of an artificial Earth satellite theory) are discussed and their characteristics are illustrated by using them to generate approximate analytical solutions for a simple dynamical system. The artificial Earth satellite problem is formulated and the applications of the techniques mentioned above to the determination of the effects of the Earth's oblateness on the motion of an artificial satellite are discussed in some detail. A comparison of the solutions indicates that Brouwer's theory appears to be superior to Ingram's for the description of long period motions since Brouwer's secular terms are more accurate than those given by Ingram and, in addition, Ingram's long period solutions are not complete. The phenomena of resonance is considered and a simple example is analyzed to demonstrate that the resonance problem is essentially a difficulty in the mathematical description of the motion. Author

N70-15739# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Geo-Astrophysics Section.
MIE SCATTERING AND THE MARTIAN ATMOSPHERE
W. G. Egan and K. M. Foreman Nov. 1969 24 p refs Presented at the Intern. Astron. Union Symp., Marfa, Texas, 26–31 Oct. 1969
(RM-461J) Avail: CFSTI

It has been suggested that the discrepancy between radio occultation determinations of the Martian atmospheric surface pressure and those deduced from optical polarization measurements and a simple Rayleigh atmosphere model are the results of submicron sized aerosols in the Martian atmosphere. Based on observed viewing angle dependence of the polarization of the Martian disk in the visual range, a Mie scattering analysis has been made utilizing the measured complex index of refraction of limonite and bulk solid CO2. The results of this study indicate that limonite aerosols alone are unsatisfactory to explain the viewing angle observations, whereas solid CO2 (and H2O ice) aerosol spheres, could bring planetary and laboratory observations into compatibility. It is suggested, further, that solid CO2 aerosols could explain limb brightening in the blue spectral range. Author

N70-15777*# Geological Survey, Washington, D.C.
INTERAGENCY REPORT: ASTROGEOLOGY 18. A PROPOSED SCHEME FOR LUNAR GEOLOGIC DESCRIPTION
John W. M' Gonigle, David Schleicher, and Ivo Lucchitta Nov. 1969 23 p refs
(NASA Order T66353G)
(NASA-CR-107672) Avail: CFSTI CSCL 03B

The process of geologic description and the problems that arise when descriptions are made under difficult conditions, such as those of lunar exploration, are considered. Both a theoretical approach and practical suggestion that should lead to more comprehensible and complete geologic descriptions are presented. Author

N70-15814*# National Aeronautics and Space Administration, Washington, D.C.
COURSE IN THEORETICAL ASTROPHYSICS
V. V. Sobolev Dec. 1969 504 p refs Transl. into ENGLISH of the book 'Kurs Teoreticheskoy Astrofiziki' Moscow, Nauka Press, 1967
(NASA-TT-F-531) Avail: CFSTI CSCL 03B

A course of lectures in theoretical astrophysics at the Leningrad University during the past 20 years is presented. Included are discussions on the following topics: the problems of the formation of continuous line spectra of stars, solar atmosphere, planetary atmospheres, the physics of gaseous nebulae, and the theory thermal radiation of supernovae and cosmic radio emission outbursts. F.O.S.

N70-15872# St. Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.
RESEARCH IN SEISMOLOGY Final Report, 1 Sep. 1965–31 Aug. 1969
Seweryn J. Duda, Carl Kisslinger, Otto W. Nuttli, and William V. Stauder 30 Sep. 1969 55 p refs
(Contract AF 19(628)-5100; ARPA Order-292)
(AD-695851; AFCRL-69-0409) Avail: CFSTI CSCL 17/10

The report contains a summary and analysis of the results of research concerned with: (1) Focal mechanisms and the properties of seismic sources, including research on methods of determination and on the relation to regional and global tectonics in selected seismic zones. (2) Determination of the magnitude and the energy-release of earthquakes. (3) Effects of earth structure on wave propagation, including determination of the distribution of seismic velocities, travel-time curves and the effect of anistropy. (4) Modal investigations of decoupling of explosions, and of seismic effects of explosions in prestressed and layered media. Author (TAB)

N70-15879# Manchester Univ. (England). Dept. of Astronomy.
RELATIVE HEIGHTS OF PHOTOGRAPHIC FEATURES OF THE MOON Scientific Report, 16 Jul. 1967–15 Jan. 1969
Zdenek Kopal, Michael Moutsoulas, and Patrick V. Sudbury Jun. 1969 80 p refs
(Contract F61052-68-C-0002)
(AD-695487; AFCRL-69-0421; SR-0002-1) Avail: CFSTI CSCL 3/2

The first part of the report is concerned with a development of the new method of star-calibrated lunar photography, which we have pursued since October 1967 to improve the basic data for studies of the shape of the Moon, and of its physical librations. The second part described the constructed astrometric camera which secures high quality stellar images for the plate calibration and the third part outlines the computer programme for the reduction of the photographic plates. The final part, concerned with astrometric studies of the natural satellites of other planets of the solar system, concludes our effort in the field and gives details of the new results obtained for Jupiter V in published form. Author (TAB)

N70-15983 Kodaikanal Observatory (India).
SUMMARY OF PROMINENCE OBSERVATIONS FOR THE SECOND HALF OF 1962, PART 1
19 Sep. 1968 313 p *Its* Bull. No. 169
(DGO-11-169) Copyright. Avail: Issuing Activity $24.84

This bulletin gives the results of Observations of prominences and calcium flocculi made at Kodaikanal Observatory during the second half of 1962 supplemented by data computed from photographs supplied by the Meudon Observatory for those days on which Kodaikanal had imperfect or no observations due to cloudy sky conditions. During the half year, photographs of calcium prominences at the limb were obtained at Kodaiknal on 99 days which were counted as 86-1/4 effective days after giving due weightage to the photographs. Spectroheliograms for 45 days were obtained from Meudon Observatory. In all, complete observations were available for 127-3/4 effective days. Author

N70-15984# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON A THERMAL MODEL OF AN ACTIVE REGION OF THE SOLAR CORONA
I. L. Beigman et al [1969] 19 p refs Transl. into ENGLISH of Acad. of Sci. USSR, Phys. Inst. Preprint No. 94
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Experimental data on the radiation spectrum of the solar corona in the X-ray range yield essential new information on the structure and composition of the corona. The spectrum in the 3 to 25 A range depends mainly on the construction of the active domain, and the abundance of iron in the corons is much greater than in the photosphere. For a unique determination of all the abundances of elements, the photospheric value of the abundance for the light elements carbon, nitrogen, and oxygen is used. Data on X-radiation in the 25A range permit construction of the most probable version of a model of the active region, and also permit additional information to be obtained on the abundance of a number of elements in the corona. R.B.

N70-15999# Weapons Research Establishment, Salisbury (Australia).
THE EFFECT OF IRREGULARITY SHAPE ON RADIO-STAR AND SATELLITE SCINTILLATIONS
D. G. Singleton Jul. 1969 32 p refs
(HSA-148) Avail: CFSTI

Current models of F region irregularities include field-aligned columns, field-aligned sheets and frontal irregularities which extend may kilometers in the horizontal direction. An irregularity model is put forward which includes these shapes as special cases. Using this model and diffraction theory, a theoretical investigation is made of the effect these shapes have on the nature of the variation

of scintillation index with the zenith angle and azimuth of the direction of propagation at a point on the ground, and the shape and orientation of the characteristic ellipse of the amplitude diffraction pattern observed at the ground. It is shown that there are characteristic differences in effects and for each type of shape considered. The possible detection of these differences experimentally and the consequent conclusions which could be drawn regarding the nature of the scintillation producing irregularities are also discussed. Author

N70-16093*# Southwest Center for Advanced Studies, Dallas, Tex.

FOURTH TEXAS SYMPOSIUM ON RELATIVISTIC ASTROPHYSICS Final Report, 1 Jun. 1968 - 31 May 1969

Stephen P. Maran and A. G. W. Cameron (Yeshiva Univ.) 1 Jul. 1969 71 p Symp. held at Dallas, 16 - 20 Dec. 1968 Sponsored in part by NASA; Southwest Center for Advan. Studies; Texas Univ., Austin; and Am. Astron. Soc.

(Grant Nonr(G)-00015-68)

(NASA-CR-107682; AD-689879; Rept-1631-1) Avail: CFSTI CSCL 03B

The fourth symposium was designed to bring together astronomers, physicists, and workers in general relativity to discuss problems of mutual interest. A large number of topics was discussed at the symposium; the current status of work in these subjects is reviewed in this report. The highlight of the symposium consisted of the papers and discussion concerning pulsars. A narrative report is given of the papers presented. TAB

N70-16117# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).

ELDO-PAS: ATTITUDE DETERMINATION DURING THE TRANSFER ORBIT WITH ASSOCIATED LAUNCH WINDOW ASPECTS

M. J. Kamphuis and P. Kant Jul. 1968 72 p refs Sponsored in part by ELDO

(NLR-MEMO-WR-68-031) Avail: CFSTI

The problem of attitude determination of the PAS vehicle during the transfer orbit is analyzed. Of the four ways using the primary angles measured by the sensors, one is discussed in detail. The problem of transforming the primary angles into a suitable set of pr5sentation angles is discussed. The use of a few sets of possible presentation angles is illustrated by the results of a number of computer runs for transfer orbits initiated at various times of the year and the day. Special attention was given to the propagation of measurement errors of the primary data into the presentation angles. It is shown that this propagation varies with the time of launch, thus imposing a possible restriction on the launch time. The computer runs also determined the launch windows imposed by the field of view restrictions of the sensors and it was found that at certain satellite positions the view on the sun of the sun sensor could be obstructed by the earth. Tables showing error propagations and graphs containing launch windows are presented. Author (ESRO)

N70-16137# National Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).

ELDO-PAS: CONSTRAINTS OF THE FIRING OF THE APOGEE MOTOR

H. J. Kamphuis 5 Feb. 1968 33 p refs Sponsored by ELDO

(NLR-MEMO-WR-68-005) Avail: CFSTI

A theoretical study is described of the effect of the errors accumulated during the transfer orbit and the apogee motor burning phase on the deviations of the near-circular satellite orbit from the synchronous orbit. From these deviations the total velocity icrement needed for synchronization of the near-circular orbit is calculated. Since the total fuel available for synchronization is limited, there is a constraint on the time of firing of the apogee motor and on the direction of its attitude prior to firing. At the same time the direction constraints are dependent on the attitude control accuracy of the subsystem. A first approximation is made towards determining these apogee firing constraints. Author (ESRO)

N70-16162# Naval Research Lab., Washington, D.C.

INCLINATION PERTURBATIONS OF POLAR-ORBIT SATELLITES Interim Report

Roger B. Cooley and Roger L. Eastern 11 Sep. 1969 28 p refs

(AD-694451; NRL-6928) Avail: CFSTI CSCL 22/3

This report describes an investigation of the ability to predict long-term orbital elements for medium-height (satellite orbiting the earth at altitudes above the regions of appreciable drag) earth-orbiting satellites. The particular types of satellites studied are those having nearly circular, polar orbits. The primary element of interest is orbital inclination. A theoretical equation for predicting the change in inclination caused by the gravitational attraction of the sun and moon is given. Expressions for the orbital elements of the sun and moon required in this inclination-predicting equation are developed. A FORTRAN program listing and computation procedure for determining the inclination of a satellite at any time after a chosen epoch is in the appendix. Nine satellites were selected for study. For these satellites, comparison plots of observed and predicted inclinations over a 3-year time interval are shown. The agreement between predicted and observed inclinations is very good for most of the satellites. Theoretical plots of the inclination of Satellite 902 over time intervals of up to 300 years are included. Author (TAB)

N70-16168# Lund Observatory (Sweden).

INVESTIGATIONS OF A REGION IN MONOCEROS: A SUMMARY

Bengt Karlsson 1969 7 p refs *Its* Ser. 1, No. 246

Avail: CFSTI

Investigations on the space densities of stars of the spectral type earlier than F8 and the interstellar extinction in a galactic field in Monoceros are summarized. The determination of luminosities and intrinsic colors on the basis of various derived spectral quantities from prism plates is mentioned. Author

N70-16203# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astro Physics Lab.

AN ANALYSIS OF THE DISTRIBUTION OF THE MAJOR SURFACE CHARACTERISTICS AND THE THERMAL ANOMALIES OBSERVED ON THE ECLIPSED MOON

Richard R. Green (Ph.D. Thesis) Jan. 1969 190 p refs

(AD-694266; D1-82-0775) Avail: CFSTI CSCL 3/2

A spherical harmonic method for trend-surface analysis of data distributed on a hemispherical surface is presented. The technique is applied in a study of lunar surficial variability in order to isolate regional from local variations in lunar surface phenomena, obtain a mathematical expression for interpretation of map variables between control points, quantitatively correlate similarities in configuration between maps of different variables, and quantitatively compare regional variability of the same parameter in widely separated regions. Correspondence between the distribution of lunar thermal anomalies and the (1) lunar albedo, (2) lunar figure, (3) distribution of average crater class, and (4) crater density is established. Contour maps and power spectra of these parameters are presented. A working hypothesis consistent with the observed relationship is introduced. Author (TAB)

N70-16204# Boeing Scientific Research Labs., Seattle, Wash.

STATISTICAL GEOMORPHOLOGY OF THE LUNAR SURFACE

L. B. Ronca and R. R. Green May 1969 40 p refs

(AD-694495; D1-82-0866) Avail: CFSTI CSCL 3/2

The report discusses the geomorphic sequence and geomorphic provinces of the lunar surface. TAB

N70-16253# Academy of Sciences (USSR), Moscow. Radium Inst.

EARLY HISTORY OF MATTER ON EARTH AND IN COSMIC SPACE FROM THE RESULTS OF ISOTOPIC DATING

I. E. Starik et al *In* Israel Program for Sci. Transl., Ltd. Probl. of Geochem. 1969 p 16–24 refs (See N70-16251 05-13)
Copyright. Avail: CFSTI

Individual stages in evolution determined chemical and isotopic compositions of cosmic bodies during formation. After termination of nucleosynthesis, cosmic dust was uniformly distributed throughout the paleosolar system. Consolidation of small radioactive asteroids resulted in metal and silicate phases and thermal fission. During this period iron meteorites of the group I were formed which possessed a silicate phase rich in original lead isotopes in contrast to group II meteorites rich in radiogenic lead isotopes Pb-206, Pb-207, and Pb-208. The constitutent matter of group 2 meteorites underwent the same evolution as earth substance on a smaller scale up to 0.5 to 2.5 billion years ago. G.G.

N70-18420# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astro Physics Lab.
A PARTICULATE THERMOPHYSICAL MODEL OF THE LUNAR SOIL
D. F. Winter and J. M. Saari Dec. 1969 56 p refs
(AD-694562; DI-82-0725) Avail: CFSTI CSCL 3/2

Calculations based on several thermophysical models of the lunar soil are compared with recent observations at far infrared wavelengths; none of the models reproduces simultaneously the lunation nighttime and eclipse cooling measurements. A new particulate thermophysical model of the lunar soil is described which utilizes results from the Surveyor spacecraft and from laboratory experiments with evacuated powders. The new model gives good agreement with both lunation and eclipse data in the far infrared and is consistent with measurements of lunar brightness temperatures at millimeter wavelengths. Particulate models are also used to determine the diurnal variation of the infrared surface brightness temperature of the hot pole of Mercury. Author (TAB)

N70-18475 Iowa State Univ. of Science and Technology, Ames.
NUMERICAL-EXPLICIT BOOST-TO-ORBIT TARGETING SCHEME
John Louis Martinsen (Ph.D. Thesis) 1968 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-4261

An explicit targeting scheme applicable to boosting payloads into near-Earth elliptical orbits is developed. The targeting scheme is of the self-contained type; that is, the entire targeting calculations can be done onboard the vehicle as it flies. A nominal trajectory is not required, and as a result extensive ground calculations are not necessary. Thus, retargeting can be accomplished almost instantaneously. At launch the vehicle's launch position, the semimajor axis, eccentricity, and inclination of the target orbit are assumed to be known. The flight profile begins with a vertical rise to clear the launch pad. This is followed by a tilt maneuver and a gravity turn. The gravity turn continues until perigee altitude is attained. Using the three specified orbital parameters a velocity-to-go based on the required orbital velocity is calculated. After perigee altitude attainment the vehicle steers to null the velocity-to-go at which point injection into orbit occurs. Dissert. Abstr.

N70-18655 California Univ., Berkeley.
CONVECTIVE ENERGY TRANSPORT IN STELLAR ATMOSPHERES
Roger Keith Ulrich (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-3714

The problem of convective energy transport in realistic model stellar atmospheres is considered. Allowance is made for the rapid change of the fundamental physical parameters with depth associated with the onset of hydrogen ionization. Under these conditions the convective flux must be considered a function of the temperature gradient over an extended region. The theoretical approach to this problem has been basically to use a modification of a mixing length theory. In this extended mixing length theory the normally unspecified convective cell has been identified with a meteorological phenomenon known as a convective thermal. This meteorological model provides the necessary information about the strength of coupling between neighboring regions. An iterative series of models has been computed to ensure that the non-locally determined convective flux together with the radiative flux are constant with depth. Dissert. Abstr.

N70-18657* Lamont Geological Observatory, Palisades, N.Y.
DEVELOPMENT OF A LUNAR HEAT FLOW EXPERIMENT FOR ALSEP Quarterly Progress Report, Jul.–Sep. 1969
Marcus G. Langseth, Jr. Sep. 1969 124 p refs
(Contract NAS9-6037)
(NASA-CR-102080; QPR-1) Avail: CFSTI CSCL 03B

The reduction of ALSEP data in terms of temperatures and temperature differences as a function of time and the reduction and interpretation of the conductivity data in real time are described. Possible disturbances of the steady-state thermal field in the lunar surface layer where the experiment to be set up are investigated. There are three main areas of investigation: (1) the decay from initial conditions; (2) the downward propagation of surface disturbances such as the temperature cycle of a lunation and changes in average temperature and thermal properties at the surface when the experiment is set up; (3) the effect of the fiber glass casing on the downward propagation of transient surface effects. Author

N70-18664 Ohio State Univ., Columbus.
THEORETICAL CONTINUOUS AND LINE SPECTRA OF STARS IN A CLOSE BINARY SYSTEM
Paul Francis Buerger (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-4852

Models have been constructed for rotationally and tidally distorted stars as they appear in synchronous, circular orbits in close binary stars. The continuous radiation emitted in the direction of the observer is computed at several wavelengths. The equivalent width of an absorption line superposed on the gray atmosphere is computed. The effects included are limb-darkening, shape distortion, variation of the effective temperature over the surface of the star, angle of inclination, and orbital phase. Hydrostatic equilibrium is assumed throughout. For absorption lines with strong temperature dependence, quite large variations of the equivalent width as functions of the separation and the orbital phase are expected. Variations with phase should show a decrease in line strength as the star is eclipsed. An extremum in the equivalent width of the line should occur at one-half phase. Dissert. Abstr.

N70-18722*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMICS OF TWO SLOWLY ROTATING POINT-MASS VEHICLES CONNECTED BY A MASSLESS TETHER AND IN A CIRCULAR ORBIT
William M. Adams, Jr. Washington Jan. 1970 28 p refs
(NASA-TN-D-5599; L-6584) Avail: CFSTI CSCL 22C

Studies were made of the dynamics of two point masses in circular orbit connected by a massless tether and rotating relative to the local vertical with angular rates of the same order of magnitude as the orbital angular velocity. Only in-plane motion in the orbital plane is considered. Results which allow prediction of the occurrence of a slack tether are obtained. The addition of damping, coupled with oscillations between a slack and taut tether, causes the system to seek closer alinement with the local vertical. Author

N70-18734# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
GRAPHITE-SILICATE GRAIN MIXTURES
N. C. Wickramasignhe (Cambridge Univ.) Nov. 1969 52 p refs
Presented at IAU Symp. no. 36, Lunteren, Netherlands, 24-27 Jun. 1969

(RIFP-98) Avail: CFSTI

Optical properties of graphite and silicate grain mixture are analyzed with emphasis on the interstellar extinction curve (IEC) in the rocket ultraviolet. Mixtures of graphite particles ejected from carbon stars and silicates from oxygen-rich giants produce excellent fits to the observed IEC over the entire wavelength range of observations. If the silicate particles acquire mantles of either ice or solid H2, agreement with the IEC remains good. Another property of graphite–silicate mixtures examined is their role in observed wavelegnth dependence of interstellar polarization. The relationship of graphite and silicate grain mixtures to the diffuse galactic light was investigated by computing the mean albedos and phase parameters for various combinations of graphite particles, silicate grains, and silicate grains covered with ice mantles. Graphite–silicate grain mixtures, which show good agreement to the IEC and to the wavelength dependence of interstellar polarization, possess albedos and phase functions which are consistent with available data on the diffuse galactic light. M.H.E.

N70-16754 New York Univ., N.Y. School of Engineering and Science.

SUB-OPTIMAL CORRECTION OF SPACECRAFT TRAJECTORIES

George J. Parkins, Jr. (Ph.D. Thesis) 1968 87 p

Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-4574

The minimum-fuel correction of spacecraft trajectories is considered. The presence of a nominal trajectory during the midcourse phase is exploited to represent the system by a set of linear, time dependent, ordinary differential equations. Both measurement and execution errors are assumed to be present so that the resulting problem is stochastic. By an application of decision theory, an open loop, fuel-optimal control is derived which is continuous in nature and dependent only on the solution of a deterministic version of the problem. A suboptimal approximation, which is on-off in nature, is presented. The suboptimal open loop control also depends only on the solution of a deterministic version of the problem, and in addition, provides a separation property whereby the estimator and the controller can be optimized separately. The results of a hybrid simulation indicate that the theoretical performance is actually obtained. Dissert. Abstr.

N70-16783 Texas Univ., Austin.

ON THE STELLAR COMPOSITION OF HALO-TYPE GLOBULAR CLUSTERS

Freddie Deward Talbert (Ph.D. Thesis) 1968 145 p

Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-6227

Low-dispersion photoelectric spectral scans of a selection of stars with low abundances of metals coupled with similar data for four halo-type globular clusters are used to estimate the stellar content of these clusters. The wavelength range of the measurements is 3350 A to 6100 A and spectral purity of the observations is 40 to 60 A. Cross-correlation of the instrumental profiles (cluster or stellar) provides a simple method of data smoothing and also aids in the determination of spectral features present in the scans. Equations which are independent of the distance to the cluster allow one to estimate the stellar composition of the clusters. The method of solution is be a least-square differential correction scheme. Several models were developed for each cluster; in general the unreddened cluster models contained relatively more blue stars than the reddened models. Several cluster models suggest that large numbers of intrinsically faint stars are not required in the cluster to provide a satisfactory mass-luminosity (visual) ratio of 0.3 to 1.0 (in solar units). Dissert. Abstr.

N70-16802 Arizona Univ., Tucson.

A SPECTROSCOPIC STUDY OF THE STELLAR CONTENT OF ELLIPTICAL GALAXIES

Elliott Paul Moore (Ph.D. Thesis) 1968 93 p

Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-5409

Models of the stellar content of the nuclei of elliptical galaxies are constructed to find the range of initial luminosity function and age consistent with observations. The assumptions include: (1) only a single generation of stars exist, (2) the initial mass function and initial luminosity function are approximated by a power law with variable exponent, and (3) color magnitude diagrams at two ages can be based on the old metal rich clusters NGC 188 and M67. Mass to light ratios and equivalent widths of thirteen spectral features are synthesized for each choice of initial luminosity function and one of two ages. A comparison of results from the models is made with observations of the ellipticals NGC 221, 3379, 4472, and of the SO NGC 3115. Dissert. Abstr.

N70-16804# Deutsche Versuchsanstalt Fuer Luft- Und Raumfahrt, Porz (West Germany).

ACTIVITY REPORTS 1968 FOR RESEARCH INSTITUTES AND SCIENTIFIC WORKING GROUPS OF THE GERMAN RESEARCH INSTITUTE FOR AVIATION AND SPACE FLIGHT AND FOR SPACE FLIGHT PROJECTS ASSIGNED TO THE DVL [TAETIGKEITSBERICHTE 1968 DER FORSCHUNGSINSTITUTE UND WISSENSCHAFTLICHEN ARBEITSGRUPPEN DER DEUTSCHEN VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT E.V. UND DER DER DVL UEBERTRAGENEN RAUMFAHRT-PROJEKTE]

Sept. 1969 242 p refs In GERMAN

Avail: CFSTI

Reported activities for 1968 centered on the construction of the central station for the German Ground Station System and the Satellite Control Centrum and their instrumentation installations. Experimental and research work describe covers flow mechanics materials testing and construction, propulsion and energy, electronic control of aircraft and satellites, and aerospace physics and medicine. Also described are programs of the scientific working committees and computer centers. Transl. by G.G.

N70-16821*# GCA Technology Div., GCA Corp., Bedford, Mass.

ABSORPTION CROSS SECTIONS OF MINOR CONSTITUENTS IN PLANETARY ATMOSPHERES FROM 1050 TO 2100 ANGSTROM

J. A. R. Samson and J. A. Myer Nov. 1969 34 p refs

(Contract NASw-1726)

(NASA-CR-107750; GCA-TR-69-7-N) Avail: CFSTI CSCL 03B

The absorption cross sections of the following gases have been measured in the wavelength range 1050 to 2200 A: O2, NO, I2, HCl, CO, Co2, So2, H2O, ICN, NH3, CH4. Curves are presented of the cross section as a function of wavelength for each gas with a short description of the important absorption features. Author

N70-16866# Council for Scientific and Industrial Research, Pretoria (South Africa).

THE MOST PROBABLE PULSATION STATES OF THE CLASSICAL CEPHEIDS [NAIVEROIATNEISHIE SOSTOIANIIA PUL'SATSII' v KLASSICHESKIKH TSEFEID]

N. N. Iakimova 1969 5 p refs Transl. into ENGLISH from Astron. Tsirkuliar, Biuro Astron. Soob. SSSR (Moscow), no. 472, 1968 p 1–4

Avail: CFSTI

In the cepheid phenomenon there are several types of variations, each occurring under its own optimum conditions. Such conditions cause various types of pulsations. Possible numerical solutions to the problem of the most probable conditions of origin of these pulsations are suggested; some may be solved by an investigation of the red long-period variables, while others are principally determined by the star temperature. Author

N70-16893# Joint Publications Research Service, Washington, D.C.

ASTRONOMY

In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 217 28 Nov. 1969 p 1–10 refs (See N70-16892 05-13)

Avail: CFSTI

Abstracts of articles on planetology, stellar emissions, and related observations are presented. A descriptive geology of Mercury, and the rotational temperature and upper pressure in the upper atmosphere of Uranus are discussed briefly. Temperature observations and diurnal variations of temperature in Martian atmosphere, and explanations of white flashes seen on Mars are described. The structure and composition of lunar crater bottoms are mentioned, along with radar observation of meteors. Radio emissions from galaxies and supernovae are studied, and the magnitudes of carbon stars are measured. Absorption spectra and variable emission of quasars are discussed. A review of submillimeter astronomy and time determination for a more accurate star catalog are also mentioned. N.E.N.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-15524*# Philco-Ford Corp., Palo Alto, Calif. Power and Control Engineering Dept.
FLIGHT DATA ANALYSIS OF POWER SUBSYSTEM DEGRADATION AT NEAR SYNCHRONOUS ALTITUDE Quarterly Report
W. T. Picciano and R. A. Reitman 5 Jan. 1970 99 p
(Contract NASw-1876)
(NASA-CR-107620; TR-DA2159; QR-2) Avail: CFSTI CSCL 22B

A study of the solar arrays on nineteen initial defense satellite communication system satellites is reported. The average degradation to cell short circuit current output, due to all cell and noncell losses, is 11.4% after 3.29 years at near synchronous orbit. The average degradation to cell open circuit voltage is 1.8%. Preliminary analysis of the reduced data suggests that dominant radiation damage is due to the trapped electron belt rather than to solar flare protons. The coverside assembly appears to degrade 2 to 5% within the first 100 days on orbit probably due to ultraviolet exposure. This is followed by a uniform 1 to 3% loss over 3.29 years. Author

N70-15615*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE GEOS-2 HEAT PIPE SYSTEM AND ITS PERFORMANCE IN TEST AND ORBIT
R. E. Harkness Apr. 1969 37 p refs Sponsored in part by NASA
(Contract NOw-62-0604-c)
(NASA-CR-107686; AD-693028; TG-1049) Avail: CFSTI CSCL 13A

The GEOS-2 Spacecraft is the first satellite to be equipped with a heat pipe as an integral part of the thermal design. The heat pipe, a device of extremely high effective thermal conductivity, is employed to minimize the temperature differences between transponders located in opposite quadrants of the spacecraft. Measured heat transfer rates through the pipe of as much as 64 watts, together with small temperature gradients on the outside of the heat pipe, are evidence of proper operation. Based on a 145-day observation period, transponder maximum and minimum temperatures show significant improvement over those of GEOS-1. Author (TAB)

N70-15688*# National Aeronautics and Space Administration, Washington, D.C.
TIROS-M: PRESS KIT
7 Jan. 1970 28 p
(NASA-News-Release-70-2) Avail: NASA Scientific and Technical Information Division CSCL 22B

Global weather prediction is expanded with the launching of the first in a new series of operational meteorological satellites. They are called TIROS-M or Improved TIROS Operational Satellite-1 (ITOS-1) in orbit, the satellite is scheduled to be launched no earlier than Jan. 15 from the Western Test Range, Lompoc, Calif. The launch vehicle will be the two-stage Delta-N which will use, for the first time, six solid-fuel, strap-on rockets for additional thrust at liftoff and at about 46,000 feet. Author

N70-15796*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EFFECTS OF SHOCK-INDUCED SEPARATION Technical Summary Report
Lars E. Ericsson, J. Peter Reding, and Rolf A. Guenther Jul. 1969 68 p refs
(Contract NAS8-20354)
(NASA-CR-107673; L-87-69-1) Avail: CFSTI CSCL 22B

The effects of shock-induced boundary layer separation on launch vehicle aerodynamics have been studied. At high subsonic speeds, local supersonic flow regions existing aft of cone-cylinder shoulders are terminated by a normal shock. The resulting boundary layer separation is shown to change the vehicle aerodynamics and can drastically affect the launch vehicle dynamics. At supersonic speeds, boundary layer separation is caused by shocks generated by interstage conical fairings. This flare-shock-induced separation does not have the classically assumed axisymmetry, but contains discrete vortices, requiring a reevaluation of existing analytic methods. It is found that a formulation is possible for the aeroelastic characteristics of Saturn launch vehicles which in most cases, will give satisfactory predictions. Author

N70-15841# Sandia Corp., Albuquerque, N.Mex.
AEROBALLISTIC, PERFORMANCE, WIND EFFECTS, AND PAYLOAD IMPACT DISPERSION ANALYSES AND FLIGHT TEST DATA FOR THE SINGLE-STAGE SANDHAWK ROCKET SYSTEM
Gerald G. Wilson and George W. Stone Jul. 1969 129 p refs
(SC-DR-69-291) Avail: CFSTI

The single-stage Sandhawk is a solid-propellant, fin-stabilized, unguided rocket system capable of carrying 200 pounds gross payload weight to an apogee altitude of 568,000 feet. The rocket incorporates either a 12-inch or a 13-inch-diameter ogive-cylinder, varying from 90 to 107 inches in length and having sufficient volume for a variety of rocket-launched experiments. Aerodynamic, performance and flight test data, together with the results of wind effect and dispersion analyses, are presented. Author (NSA)

N70-15876*# Illinois Univ., Urbana. Coordinated Science Lab.
A STUDY OF EFFECTS OF THE GAS-SURFACE INTERACTION ON SPINNING CONVEX BODIES WITH APPLICATION TO SATELLITE EXPERIMENTS
Gerald Ray Karr (Ph.D. Thesis) Sep. 1969 165 p refs
(Contracts NAS8-21442; DAAB07-67-C-0199)
(NASA-CR-107693; AD-695522; R-435) Avail: CFSTI CSCL 22/2

In rarefied gas flow problems there are two effects which influence the flow: (1) collisions of gas molecules with other gas molecules, and (2) collisions of gas molecules with solid surfaces (the gas-surface interaction). This study deals with free molecular flow in which the effect of gas-gas collision can be neglected and the gas-surface interaction has the dominate influence on the flow. The results of this study have application to satellites since free molecular flow conditions occur at orbital altitudes above 120 km. Knowledge of the gas-surface interaction is required in order to determine the aerodynamic properties of satellites. At satellite velocities (7-8 km/sec) the interaction of neutral atmospheric gas molecules with the satellite surface occurs at energies in the 1 to 10 ev range. It is just this energy range which has not been satisfactorily duplicated in the laborstory. Therefore, at present, laboratory gas-surface interaction data can not be applied directly to the determination of the aerodynamics properties of satellites.

It is proposed in this study that satellite experiments be performed to obtain the needed information from measurements of the aerodynamics properties of satellites. In order to interpret the satellite data, a generalized gas-surface interaction model was developed and used in the analysis of this study. Author (TAB)

N70-15893# Technische Hochschule Munchen (West Germany). Inst. fuer Raumfahrttechnik.
CRITICAL REVIEW OF SPACE TRANSPORTER STUDIES [KRITISCHER ERGEBNISBERICHT UEBER RAUHTRANSPORTERSTUDIEN]
Otto Reidelhuber and Alwin Suess Apr. 1969 237 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Wiss. Forsch.
(BMWF-FB-W-69-36) Avail: CFSTI

The results of the feasibility studies of nine aerospace transporters which mainly differ with regard to their take-off mode and propulsion system are presented. The attempt of a qualitative evaluation leads to no distinct superiority of one of the proposed systems above the others. At the present standard of technology, however, systems with rocket engine propulsion are superior to systems with airbreathing engines in the first stage with respect to performance, cost, and risk of development. The necessary integration of the aerospace transporter into a long-running comprehensive space program is pointed out. Author (ESRO)

N70-15922# Sandia Corp., Albuquerque, N.Mex.
ABLATION AND THERMAL ANALYSIS OF THE APOLLO LUNAR RADIOISOTOPIC HEATER
D. W. Larson Jul. 1969 137 p refs
(SC-RR-69-303) Avail: CFSTI

The ablation and thermal response of the Apollo Lunar Radioisotopic Heater (ALRH) was determined for orbital decay atmospheric reentry, lunar return prompt reentries, and multiple orbit reentries from near lunar apogees. The temperature response of the ALRH was also determined for operational and other steady state conditions. Author (NSA)

N70-16015# Joint Publications Research Service, Washington, D.C.
SELECTION OF A CRITERION FOR EVALUATING ILLUMINATION CONDITIONS IN SPACE CABINS
E. S. Kotova et al *In its* Space Biol. and Med., Vol. 3, no. 5 31 Dec. 1969 p 111-117 refs (See N70-16001 05-04)
Avail: CFSTI

This paper gives information on the selection of illumination conditions in space cabins. The use of indices of object visibility as a criterion indicating the quantitative level of visual perception under given illumination conditions is recommended. Experimental data are given on visibility limits for luminous objects relative to different levels of luminance distribution within a cosmonaut's field of view. The threshold level of object visibility was found to be V = 0.25 0.25 log-thr. This is the level at which inevitable errors in information reading appear. Author

N70-16395# European Space Research Organization, Paris (France)
PROGRESS IN OPERATIONAL PROGRAMME [ETAT D'AVANCEMENT DU PROGRAMME OPERATIONNEL]
In its ESRO/ELDO Bull. No. 7 Oct. 1969 p 15-24 (See N70-16392 05-34)
Avail: CFSTI

This article reviews operations of the ESRO-1, ESRO-2, and HEOS-1 satellites and reports on the launching of the fourth ESRO satellite ESRO-1 b (Boreas) which was successfully placed in orbit on 1 October 1969. Development activities concerning the HEOS-2 and TD satellites and studies on the future programs COS B and the scientific geostationary satellite are also considered. There are also reports on sounding rocket experiments and a series of trials for the recovery of sounding rocket payloads from the sea. ESRO

N70-16491# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.
COMPUTED GRAPHICS TECHNIQUES FOR STRUCTURAL SHELL ANALYSIS
D. M. Purdy, T. N. Bernstein, and V. A. Tischler Jul. 1969 83 p refs
(AD-694077; AFFDL-TR-68-166) Avail: CFSTI CSCL 22/2

Complex shell of revolution problems are frequently encountered in the design of aerospace vehicles. Several techniques have evolved which will provide satisfactory solutions for these problems. The three techniques which have become the most widely used, namely the discrete element approach, the finite difference approach, and direct numerical integration, all require the use of a digital computer. In the present paper, a method is developed which will transform the solutions, regardless of how they are obtained, into functions of a single, consistent, independent variable. This transformation which is straightforward for shells such as cylinders, cones, and spheres but complex for shells such as paraboloids, ellipsoids, and hyperboloids, makes it possible to obtain a consistent graphical representative of the variables over the entire shell. This method is applied to an existing shell analysis program and solutions to selected problems are obtained in graphical form. The computer routines required for the plotting of solutions and the instructions for modification of existing shell analysis computer programs are included. Author (TAB)

N70-16658# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
APOLLO/SURVEYOR TEST PLAN. PLAN FOR POSTFLIGHT TEST AND ANALYSIS OF PARTS AND MATERIALS OF SURVEYOR 3, RETRIEVED FROM LUNAR SURFACE BY APOLLO 12. VOLUME 1: TECHNICAL PLAN
Nov. 1969 199 p
(Contract NAS9-10337)
(NASA-CR-102099; SSD-90397R) Avail: CFSTI CSCL 22A

The Apollo 12 spacecraft is programmed to land on the lunar surface in the immediate vicinity of the Surveyor III spacecraft. Therefore, there is a unique opportunity to recover and evaluate a variety of materials and electronic and mechanical components and subsystems which have been exposed to the lunar environment for the past 2-1/2 years. Significant engineering data of value in designing space systems can be obtained, as well as fundamental scientific knowledge in the fields of physics and biology. Included in the mission of Apollo 12 is a plan for the astronauts to retrieve certain parts of the Surveyor III spacecraft. These parts were selected for retrieval: (1) The television camera, (2) A 5 inch section of the TV support tube, coated with white aluminum paint, (3) A piece of TV cable approximately 8 inches long, (4) A piece of unpainted aluminum support tube approximately 6 inches long, (5) A piece of the thermal switch mirror, and (6) A piece of kapton insulation. Author

N70-16659 Illinois Univ., Urbana.
CONFIGURATION INSTABILITY AND DESPIN OF CROSSED-DIPOLE SATELLITES DUE TO THE EARTH'S GRAVITY FIELD
Frank Robert Vigneron (Ph.D. Thesis) 1968 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-1476

Equations of motion of an earth satellite with long, flexible appendages are formulated in a form useful for investigating the deforming action and resulting dynamical mechanisms of the gravity field. They are solved by analytical means to demonstrate the mechanisms of dynamic elastic stability of configuration and long-term spin behavior. The elastic stability of both flexural and

longitudinal modes of deformation of gravity-captured and spin-stabilized satellites is studied. Solutions of long-term spin behavior demonstrate the effects of structural damping, structural resonance, and solar-induced deformations. It is found, however, that the effects are of major importance for spin-stabilized satellites of larger dimension: for example, satellites of the dimension of the Radio Astronomy Explorer. The existing data of the spin history of the Explorer 20 satellite is examined to show evidence of spin change due to solar-induced deformations. Dissert. Abstr.

N70-16792# Northrop Corp., Hawthorne, Calif. Systems Labs.
ORBITAL VEHICLE MODEL 5, ARTICLE 9 Final Technical Report
H. Ayers 1969 51 p
(Contract F04701-68-C-0233)
(AD-694103; NORT-69-600) Avail: CFSTI CSCL 22/2

The OV5-9 Satellite is designed to measure the energetic particles and X-rays emitted by the sun during solar particle events. A secondary mission is to study the trapped electrons and protons near synchronous altitudes. These measurements will be carried out in an elliptical orbit so that data will be obtained outside the magnetosphere as well as inside. Thus, penetration of particles into the magnetosphere, and especially to synchronous altitudes, will be measured. Author (TAB)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-15505*# Southampton Univ. (England). Inst. of Sound and Vibration Research.
RESPONSE OF BOX-TYPE STRUCTURES TO SONIC BOOMS
Neil Popplewell (Ph.D. Thesis) 1969 186 p refs
(Grant NGR-52-025-003)
(NASA-CR-66887) Avail: CFSTI CSCL 20L

A Finite Element Displacement Method of analysis is developed, in conjunction with a modelling technique, to determine the response of a box-type structure to sonic booms. Both techniques are regarded as being complementary, and are developed systematically in order to assess their accuracy at each intermediate stage. The basic formulation of the Finite Element Method is checked by comparing the natural frequencies and mode shapes of a freely vibrating box with known solutions. A theoretical description of the flow of an arbitrarily shaped wave over a box-type structure is formulated. The resulting theoretical wave-forms are compared with the forms of sonic booms observed on different faces of a structure in order to test the validity of the simplifying assumptions. The response of the box's mathematical model to the results are used to predict a safe damage criterion for the walls of a single storey house which are subjected to a sonic boom. Although this criterion is based upon damage from blasting operations, it gives results which are consistent with known damage from sonic booms. Author

N70-15531# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
OVAL RING WITH STIFFENERS
William P. Vafakos, Jerrold Housner, and William L. Brodsky Aug. 1969 65 p refs
(Contract Nonr-839(39))
(AD-693975; PIBAL-69-31) Avail: CFSTI CSCL 13/13

The behavior of a doubly symmetric oval ring, with a pair of stiffeners parallel to either the major or minor axis, subjected to a uniform radial load is investigated. Solutions are obtained by superimposing oval ring solutions for loading conditions corresponding to four symmetrically placed concentrated forces, four similarly placed concentrated moments, and a uniform radial load. The magnitudes of the concentrated forces and moments are determined by matching the deformations of both the oval ring and the stiffeners at their points of contact. It is shown that there exists an optimum placement of the stiffeners which minimizes the maximum bending stress. Also, it is shown that the common assumption of inextensional deformations leads to gross physical errors, especially when applied to those cases in which stiffeners are placed near the extremities of the oval. In such cases the extensional deformations in both ring and stiffener play a crucial role which cannot be neglected. Graphs of the bending moments and interaction loads are exhibited for a series of oval rings having different placements of the stiffeners. Author (TAB)

N70-15569*# Techtran Corp., Glen Burnie, Md.
METHODS OF FORECASTING THE VIBRATIONS OF A LINEAR STRUCTURE SUBJECTED TO AN EVENTFUL EXCITATION [METHODE DE PREVISION DES VIBRATIONS D'UNE STRUCTURE LINEAIRE SOUMISE A UNE EXCITATION ALEATOIRE]
Alain Bourgine Washington NASA Jan. 1970 16 p refs Transl. into ENGLISH from French report ONERA-TP-703
(Contract NASw-1695)
(NASA-TT-F-12775; ONERA-TP-703) Avail: CFSTI CSCL 20L

Using some concrete examples, the importance of the problem of random vibrations in the special case of aircraft and vehicle structures is shown, and the necessity for forecasting risks associated with them, a report is made of the principle findings from calculation of statistical characteristics of the response of a linear structure subjected, on its boundary, to a stationary random excitation. The representation of the structural movements in the base of its characteristic modes of vibrations allows display of important physical parameters of the problem (damping, direct and intersected spectra of excitation, coincidence phenomenon). Nevertheless, this approach often meets considerable difficulties in application. A total approach, based on the generalized Green function concept, avoids the preceding difficulties and allows proposal of a new method for characterizing complex structures. Some experimental findings are presented. Author

N70-15584*# University of Southern Calif., Los Angeles. Dept. of Civil Engineering.
IMPACT STRESSES AND DEFORMATIONS IN SPHERICAL SHELLS Final Report
N. E. Johnson and M. P. Bieniak Feb. 1969 231 p refs
(Grant NGR-05-018-056)
(NASA-CR-107587) Avail: CFSTI CSCL 20K

This report contains a study of the dynamic response of a spherical shell colliding with a specially developed elastic surface. The analysis is based on the membrane theory and the bending theory with transverse shear deformation taken into account. The fundamental properties of the stress waves in spherical shells are investigated. The solution of the impact problem is developed in the form of a natural mode series and by the method of characteristics. Author

N70-15637*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELASTIC AND PLASTIC STRESSES AT WELD SINKAGES AND OTHER DISCONTINUITIES IN PRESSURE VESSELS
J. Skogh and A. M. C. Holmes Oct. 1969 240 p refs
(Contract NAS9-8303)
(NASA-CR-102071; LMSC-4-05-69-7) Avail: CFSTI CSCL 20K

Two problems of geometric discontinuities in pressure vessels are treated in detail: mismatch and weld sinkage. Design graphs are given for elastic stresses in such discontinuities for arbitrary materials and a wide range of geometries. Nonlinear pressure coupling effects are included. Design graphs for plastic stresses,

including residual stress, are given for cylinders and spheres with weld sinkage type discontinuities. These graphs are applicable to materials with stress-strain curves resembling that of titanium 6Al-4V. Failure criteria for static and cyclic loadings are discussed. The methods employed in generating the data required for the design graphs consisted of a synthesis of asymptotic, closed form solutions and parametric computer studies. The theoretical results were checked with a test program using cylinders and spheres with weld sinkage type discontinuities. Excellent correlation between theory and test was achieved. In addition to the solutions of mismatch and weld sinkage problems, recommended engineering solutions for a large number of discontinuity problems are given in a matrix with systematically classified discontinuities. Author

N70-15643*# Bellcomm, Inc., Washington, D.C.
RESPONSE OF SIMPLY SUPPORTED TIMOSHENKO BEAMS
R. J. Ravera 14 Nov. 1969 28 p refs
(Contract NASw-417)
(NASA-CR-107588; TM-69-1022-11) Avail: CFSTI CSCL 20K

A method to determine the response of simply supported, finite Timoshenko beams under any general time and space dependent loads is illustrated. The simply supported end conditions permit the use of finite Fourier transform methods which, when coupled with the Laplace transform technique, leads to a relatively straightforward solution. The general method is applied to the problem of a suddenly applied load at the beam mid-span. Author

N70-15656# Illinois Univ., Urbana.
A FINITE ELEMENT ANALYSIS OF ECCENTRICALLY STIFFENED CIRCULAR CYLINDRICAL SHELLS
P. C. Kohnke (Ph.D. Thesis) and W. C. Schnobrich Oct. 1969 94 p refs *Its* Civil Eng. Studies Structural Res. Ser. No. 351
(Contract N00014-67-A-0305-0010)
(AD-695743) Avail: CFSTI CSCL 13/13

The objective of this study is the development of an analysis method capable of handling circular cylindrical shells that have been stiffened both in the axial (longitudinal) and circumferential (hoop) directions by beamlike members. Further, it is desired to allow these stiffeners to be placed eccentrically, that is, the centroid of the stiffener not coinciding with the shell. Seldom are they placed symmetrically because of fabrication problems and loss of efficiency of the stiffener. The eccentrically stiffened cylindrical shell represents a broad range of practical structures, including airplane fuselages, rocket casings, nuclear reactor containment vessels, and cylindrical roof shells. Author (TAB)

N70-15728*# Southwest Research Inst., San Antonio, Tex.
STUDY OF EXPLOSIONS IN THE NASA-MSC VIBRATION AND ACOUSTIC TEST FACILITY (VATF) Final Report
Wilfred E. Baker, Sandor Silverman, and Tom O. Dunham Mar. 1968 32 p refs
(Contract NAS9-7749; SwRI Proj. 02-2309)
(NASA-CR-107680) Avail: CFSTI CSCL 20K

The results are given of a study of the effects of bursting of helium pressure bottles in the Apollo service module while the spacecraft is undergoing vibration or acoustic testing. The damage potential of the two 40.2 inch diameter titanium alloy pressure spheres located in the service module is assessed relative to the spacecraft vibration laboratory, the spacecraft acoustic laboratory, and adjacent areas. Effort was geared to the determining of maximum pressures which can be tolerated in the vessels consistent with present design criteria. Methods are given for modifying and safeguarding the facilities to minimize damage to structures and personnel. Author

N70-15743# Royal Aircraft Establishment, Farnborough (England). Ministry of Technology.
A CONTRIBUTION TO THE STUDY OF A SEMIAUTOMATIC METHOD FOR FINDING THE DISTRIBUTION OF EXCITATION FORCES IN AIRCRAFT RESONANCE TESTS [CONTRIBUTION A L'ETUDE D'UNE METHODE SEMIAUTOMATIQUE D'APPROPRIATION DES FORCES D'EXCITATION DANS L'ESSAI AU SOL D'UNE STRUCTURE D'AVION]
Alphonse Deck and D. R. Gaukroger, ed. Jun. 1969 86 p refs
(RAE-LIB-Trans-1393; ONERA-NT-129) Avail: CFSTI

After a brief survey of the global method of resonance testing, the theoretical possibility of isolating a normal mode of a complex structure are examined. The practical problems are discussed, and a critical analysis of existing methods is given. A theoretical and experimental study of a systematic iteration method for finding the distribution of excitation forces is described. The method enables the natural frequency and the excitation forces required to isolate a mode at that frequency, to be determined. Finally the practical application of the proposed method are described. The analysis of the response of the structure by a sampling technique is described and the central component of the system is an industrial-type digital computer. Author

N70-15744# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
PROGRESS IN AEROELASTIC OPTIMIZATION: ANALYTICAL VERSUS NUMERICAL APPROACHES
S. C. Mc Intosh, Jr., T. A. Weisshaar, and H. Ashley Jul. 1969 43 p refs Presented at AIAA Structural Dyn. and Aeroelasticity Specialist Conf., Apr. 1969, New Orleans
(Grants NGR-05-020-102; NGR-05-020-243; Contract F44620-68-C-0036)
(NASA-CR-107675; SUDAAR-383) Avail: CFSTI CSCL 1C

A summary is given of recent developments in aeroelastic optimization, with emphasis on difficulties encountered in treating examples numerically by adaptation of techniques from optimal control theory. The elementary problem of finding the unswept wing of least skin mass for fixed torsional divergence speed is used to show how a numerical transition-matrix solution is easily obtained that reproduces accurately the analytical solution. Other problems are then considered to illustrate the application of transition-matrix or gradient methods where solutions are not so easily found. An attempt is made to identify those methods most likely to be successful and to outline some of the difficulties involved in applying them to aeroelastic optimization. Author (TAB)

N70-15760*# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
CHARACTERIZATION OF THE PHYSICAL PROPERTIES OF WEB-STIFFENED SANDWICH STRUCTURES
Youl-Nan Chen, David Ranlet, and Joseph Kempner Aug. 1968 59 p refs Sponsored in part by NASA
(Contract Nonr-839(39))
(NASA-CR-107705; AD-691838; PIBAL-69-30) Avail: CFSTI CSCL 20K

Presented is a means of representing the physical properties of and stress-strain laws for circular, cylindrical, web-stiffened sandwich shells. The face layers are treated as thin shells in which the classical theory of shells applies, while shear deformations are permitted in the core. Except for the inclusion of an average second-order shear modulus, the structural core is treated as a layer of inhomogeneous orthotropic material comprised of a series of webs considered as discrete elements. A partial justification of the concept of an average secondary shear modulus is given by the results of two static beam-type problems involving web-stiffened structures. Author (TAB)

N70-15779# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
DERIVATION OF STIFFNESS MATRICES FOR BEAM TYPE ELEMENTS
P. W. Sharman and M. G. Hawkins (B.A.C.) Aug. 1969 41 p refs

(TT-6913) Avail: CFSTI

Explicit matrices and Fortran IV listings are given for various beams, including offset nodes, inclined principal axes, flexible joints, finite shear stiffness. Author

N70-15842# Sandia Corp., Livermore, Calif.
ANALYSIS OF SHALLOW SPHERICAL CANTILEVER SHELLS AND SHALLOW SPHERICAL DOMES WITH POLAR OPENINGS UNDER ANTISYMMETRICALLY DISTRIBUTED LOADS
Oemer A. Fettahlioglu Sep. 1969 254 p refs
(Contract AT(29-1)-789)
(SCL-RR-69-80) Avail: CFSTI

A mathematical analysis of the stresses and deflections in thin shallow spherical shells subjected to antisymmetrical distributed loads is presented. The shells are considered to be of constant thickness and isotropic construction and to be supported continuously either near the apex or along the outer boundary by a rigid ring. A simplified yet accurate analysis is accomplished by the application of bending shell theory. The equations are specialized to provide solutions for either fixed or simple support configurations. Results are presented in the form of nondimensional curves which provide stress resultants and displacements in the most general form. Author (TAB)

N70-15884# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
RED HERRING AND SUNDRY UNIDENTIFIED FISH IN NON-LINEAR CONTINUUM MECHANICS
R. S. Rivlin Sep. 1969 37 p refs
(Contract N00014-67-A-0370)
(AD-695773; CAM-100-9) Avail: CFSTI CSCL 20/11

Since the Second World War, there has been a rapid development in the non-linear continuum mechanical theories of elasticity and viscoelasticity. The salient stages in the development of these theories are discussed. Various concepts which have been proposed are discussed critically both with respect to logical status and physical relevance. These include the principle of material frame-indifference, certain thermodynamic theories as they apply to continua, and the axiomatization of mechanics. TAB

N70-16110# National Physical Lab., Teddington (England). Aerodynamics Div.
THE INVESTIGATION OF THE AEROELASTIC STABILITY OF MODELS OF THE ERSKINE BRIDGE AT VARIOUS ERECTION STAGES
D. E. Walshe Feb. 1969 26 p refs
(NPL-AERO-SR-022) Copyright. Avail: CFSTI

The amplitude of wind-excited oscillations of the Erskine bridge at four erection stages were predicted from tests on a full aeroelastic model of the bridge. The results of the tests indicate that no severe instability is to be expected. Author (ESRO)

N70-16111# National Physical Lab., Teddington (England). Aerodynamics Div.
WIND-PRESSURE MEASUREMENTS ON THE ROOF OF A MODEL OF THE AUDITORIUM PROPOSED FOR THE MECCA HOTEL AND CONFERENCE CENTRE
R. E. Whitbread May 1969 23 p refs
(NPW-AERO-SR-026) Avail: CFSTI

Measurements of the surface pressure distribution on a model of the cable-suspended roof proposed for the auditorium were undertaken to provide the wind-load data necessary to check that no undue movement of the roof could take place in wind. The tests were carried out in a wind-speed gradient appropriate to the site, and surrounding buildings were included in the model to simulate any local variations in wind speed. Author (ESRO)

N70-16155 Netherlands Research Centre TNO for Shipbuilding and Navigation, Delft. Shipbuilding Dept.
THE DESIGN OF U-TANKS FOR ROLL DAMPING OF SHIPS
J. D. Van Den Bunt Oct. 1969 20 p refs
(Rept-124-S; S2/150) Copyright. Avail: Issuing Activity

Mathematical apporach, design criteria, designing procedure and also general shape of the U-tank are improved. The influence of wave height and tank length on the efficacy of the U-tank is illustrated. A method is given for adaptation of the U-tank to strongly varying loading conditions of the ship. Finally some practical information is presented on the attainable stabilizing effect of U-tanks of different sizes for ships having different displacements and different loading conditions. Author

N70-16171# Council of Scientific and Industrial Research, New Delhi (India). Aeronautical Research Committee.
ESTIMATION OF THE RATE OF PROPAGATION OF FATIGUE CRACKS
S. K. Bhandari and S. Ramamritham Aug. 1969 34 p refs
(ARC-TN-3) Avail: CFSTI

Experimental data on fatigue crack propagation in aluminum alloy sheets obtained by a number of workers were analysed. An expression was derived for the rate of fatigue crack propagation in terms of the basic parameters of fatigue loading, material property and width of sheet. This agrees with the experimental observations of almost all the workers in the field. It was also found that the rate of crack propagation from initiation to final fracture is in three stages. The first stage extends from initiation of crack up to about 20 per cent of specimen width and consumes almost 80 to 90 per cent of the life of the specimen. The expression derived in this note is applicable to the first stage, which is the one of importance to designers and engineers. Author

N70-16194# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
DISCRETE ELEMENT ANALYSIS OF THE LATERAL VIBRATION OF RECTANGULAR PLATES IN THE PRESENCE OF MEMBRANE STRESSES
D. J. Dawe London HMSO 1969 25 p refs Supersedes (RAE-TR-68233; (ARC-31065)
(ARC-CP-1062; RAE-TR-68233; ARC-31065) Copyright. Avail: HMSO 5s 6d; BIS $1.10; CFSTI

The discrete element displacement method is applied to the prediction of the natural frequencies of lateral vibration of rectangular plates which may be subjected to arbitrary systems of in-plane loading. Numerical results are given for several problems in which the applied stress system is uniform and these results are shown to be in good agreement with available solutions. Author (ESRO)

N70-16339# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
A PROBABILISTIC INTERPRETATION OF MINER'S RULE-2
Sam C. Saunders Jul. 1969 34 p refs *Its* Mathematical Note-617
(AD-694370; DI-82-0899) Avail: CFSTI CSCL 20/12

An attempt is made to find physically realizable conditions under which both upper and lower bounds on the expected number of cycles until failure can be found and expressed by a formula which is a generalization of a variant of Miners rule. It is concluded that a variation of Miners rule gives a conservative lower bound for the expected number of cycles until failure under very general conditions. TAB

N70-16408 Virginia Univ., Charlottesville.
PLASTIC BUCKLING OF AXIALLY COMPRESSED TRUNCATED CONICAL SHELLS
Nachiappan Shanmugam (Ph.D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-18232

Axisymmetric plastic buckling loads for simply supported, axially compressed, truncated conical shells made of a material characterized by a bilinear stress strain diagram was determined. The existing methods of classical plastic buckling analysis are first extended to such shells. Then a method of large deflection plastic buckling analysis for such shells, based on a more rigorous theory of plasticity, is developed. Axisymmetric buckling of the shell is assumed in all the methods of analysis. Dissert. Abstr.

N70-16465*# Boeing Co., Seattle, Wash. Aerospace Systems Div.

INVESTIGATION OF DEEP FLAWS IN THIN WALLED TANKS

J. N. Masters, W. P. Haese, and R. W. Finger Dec. 1969 140 p refs

(Contract NAS3-10290)

(NASA-CR-72608) Avail: CFSTI CSCL 20K

The conditions controlling fracture instability and subcritical flaw growth in relatively thin sections containing deep surface flaws were experimentally investigated for 2219-T87 aluminum and 5Al-2.5Sn titanium base metal and weldments. The program consisted primarily of testing uniaxially loaded surface flawed specimens in ambient, liquid nitrogen, and liquid hydrogen environments. It was concluded that for test conditions in which the plastic zone size is relatively small with respect to the thickness, well ordered static and cyclic data is generated, and experimentally determined deep flaw magnification factors adequately describe the fracturing process. As relative thickness is reduced, combinations of stable flaw growth and plasticity effects control, and cyclic flaw growth rates increase rapidly. In the extreme case, (very thin gages with respect to the plastic zone size) the surface flaw grows through the thickness, under rising load, and ultimately fails as a through-the-thickness crack. Author

N70-16477 Rensselaer Polytechnic Inst., Troy, N.Y.

VIBRATIONS OF AN INFINITE PLATE BASED ON THE DYNAMIC THEORY OF THERMOELASTICITY

Donald F. Mowbray (Ph.D. Thesis) 1968 185 p

Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-2471

The problem of free vibrations of an infinite plate of uniform, arbitrary thickness, based on the dynamic theory of thermoelasticity is considered. The dynamic thermoelastic theory includes the fact that a variation of strain in an elastic body is accompanied by a variation in temperature, which in turn affects the variation of strain. The equations of motion and the energy equation are therefore interdependent (or coupled) and cannot be treated independently, as is possible for static thermoelasticity problems. The transcendential equations describing the frequency of vibration – wave number relationships for the cases of adiabatic and isothermal heat transfer conditions at the plate surfaces are evaluated by numerical techniques. The numerical results allow the significance of the coupling of the elastic and thermal deformation fields to be evaluated with respect to the vibration amplitude-attenuation and phase velocity, and the specific energy loss for a vibration cycle. Dissert. Abstr.

N70-16479 Texas Univ., Austin.

CRACK INITIATION DURING FATIGUE

Walter Lee Bradley 1968 102 p

Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-6120

It has been the purpose of this research to investigate vacancy mobility during fatigue to try to substantiate the vacancy coalescence model of fatigue crack formation. Strain aging and resistivity experiments have recently suggested the existence of a strong dislocation-vacancy interaction. If such an interaction does exist, it would seem reasonable that dislocation motion during fatigue could assist by some as yet unknown mechanism the vacancies in their movement through the lattice, giving a much lower energy of migration. Vacancies are continuously generated during fatigue, resulting in a nonequilibrium vacancy concentration which depends on vacancy mobility. A mathematical expression has been derived to describe this vacancy supersaturation as a function of temperature and energy of migration. The vacancy supersaturation at three temperatures has been obtained through measurements of resistivity changes during room temperature annealing of specimen previously fatigued. Dissert. Abstr.

N70-16498# Oak Ridge National Lab., Tenn.

COMPARATIVE CREEP-RUPTURE PROPERTIES OF W-25 PERCENT Re CONSOLIDATED BY ARC MELTING AND POWER METALLURGY TECHNIQUES

R. L. Stephenson Sep. 1969 15 p

(Contract W-7405-eng-26)

(ORNL-TM-2651) Avail: CFSTI

The creep-rupture properties of W-25% Re materials consolidated by arc melting (AM) and powder metallurgy (PM) techniques have been compared at 1650 and 2200 C for rupture times up to 1000 hr. At comparable stresses, PM material has a shorter rupture life and a lower rupture ductility than AM material. On the basis of secondary creep rate, PM material is weaker than AM material at 1650 C but stronger at 2200 C. Optical and electron metallography showed that voids form at grain boundaries in both materials. In the PM material, grain boundaries appear to be immobile, and massive growth of voids initiates fracture with very little deformation. In the AM material, grain boundaries appear to be mobile, and fracture seems to be forestalled by their ability to move. The relative creep rates can be explained on the basis of void growth and grain size. Author (NSA)

N70-16666 California Univ., Berkeley.

A TAU-DECOMPOSITION METHOD OF STABILITY ANALYSIS FOR RETARDED DYNAMICAL SYSTEMS

Muo Shuen Lee (Ph.D. Thesis) 1968 106 p

Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-3644

The present investigation deals with a method for studying the effects of the amount of time lag on the stability of dynamical systems. The method of analysis involves, first, decomposing the positive time lag axis into many intervals within each of which the stability character remains unchanged. For the change of stability character from interval to interval the result is expressed geometrically in terms of the leaving or entering of a unit circle by a curve which is determined by a rational function. The present investigation extends the work of Krall, and extends and modifies the earlier work of Sokolov and Miasnikov. To illustrate the procedure of this method, some nontrivial examples and miscellaneous applications are given. Also discussed in the paper is a modified procedure for extending this method to dynamical systems with two time lags. Dissert Abstr.

N70-16667 Michigan State Univ., East Lansing.

END EFFECT IN A TRUNCATED SEMI-INFINITE WEDGE AND CONE

Tommie Ray Thompson (Ph.D. Thesis) 1968 71 p

Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-5973

The purpose of this research is to develop the stress distribution in a two-dimensional truncated semi-infinite wedge and in a three-dimensional truncated semi-infinite cone. Using a complex values eigenfunction expansion for an Airy stress function formulation of the wedge problem, the stress distribution within the St. Venant boundary region is determined for several "typical" loadings. The solution for the cone problem is formulated in terms of Papkovich-Neuber functions and the resulting stress distribution in the cone is also determined. Eigenvalues for both problems are presented for several wedge and cone angles. Dissert. Abstr.

N70-16868 Ohio State Univ., Columbus.
A STUDY OF THE EFFECTS OF COUPLING BETWEEN BENDING AND STRETCHING ON THE MECHANICAL BEHAVIOR OF LAYERED ANISOTROPIC COMPOSITE MATERIALS
James Martin Whitney (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-5000

Using the basic assumptions of thin plate theory, including nonlinear terms in the von Karman sense, the governing equations of a laminated aniactropic plate are formulated. In particular, the type of plate under discussion consists of n layers of orthotropic sheets bonded together. Each layer has arbitrary thickness, elastic properties, and orientation of orthotropic axes with respect to the plate axes. The governing equations are obtained by integrating the equations of nonlinear elasticity over the plate thickness. Inertia terms and thermal stresses are included. Resulting equations show the existence of a coupling phenomenon between bending and stretching not found in the linear theory of homogeneous plates. For laminates which are symmetrically oriented about the middle plane, coupling is shown to vanish and the governing equations reduce to those of a homogeneous anisotropic plate. Dissert. Abstr.

N70-16874# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
ARPA-NBS PROGRAM OF RESEARCH ON HIGH TEMPERATURE MATERIALS Technical Note 1 Jul. – 31 Dec. 1968
A. D. Franklin Sep. 1969 29 p refs
(AD-695461; NBS-TN-494) Avail: CFSTI CSCL 11/7

Topics include the optical constants of titanium, diffusion of oxygen in oxides, growth of Al2O3, bicrystals by chemical vapor deposition, high temperature creep in copper, fracture in glass, the electronic structure of transition metal borides and related compounds, the enthalpy of pyrolytic graphite at high temperatures, the mechanism of volatilization of polymers, and the interaction between mechanical relaxation and annealing in polymers. Author (TAB)

N70-16724*# Aerojet-General Corp., Azusa, Calif. Structural Composites Dept.
ANALYSIS OF FILAMENT-WOUND DOME AND POLAR BOSS OF METAL-LINED GLASS-FILAMENT-WOUND PRESSURE VESSELS
R. E. Landes and E. E. Morris Jan. 1970 112 p refs
(Contract NAS3-10289)
(NASA-CR-72599; AEROJET-3788) Avail: CFSTI CSCL 20M

Structural analysis of an aluminum-lined glass-filament-wound pressure vessel was conducted. Pressure vessel design criteria were reviewed, and filament strength levels and the vessel configuration were established using netting analysis of the membrane, discontinuity analysis of the dome-to-cylinder junctions, and wrap-pattern calculations. The vessel's dome was characterized and a discontinuity analysis of the polar-boss region was completed. Axial polar-boss design concepts were reviewed, and detailed structural analyses of two configurations were carried out. Then the polar-boss designs were incorporated in the membrane analysis. Author

N70-16725# Brown Univ., Providence, R.I. Div. of Engineering.
BOUNDING PRINCIPLES FOR DYNAMICALLY LOADED STRUCTURES COMPOSED OF TIME INDEPENDENT MATERIALS
John B. Martin and J. Declan O'Keeffe Jul. 1969 135 p refs
(Contract N00189-68-C-0157)
(AD-694997; BU/NSRDC/14) Avail: CFSTI CSCL 20/11

Energy techniques for determining upper bounds on displacements for dynamically loaded elastic and elastic-plastic structures are reviewed. Greatest emphasis is given to impulsive loading. The basic theory is presented for elastic, rigid-plastic, and elastic-plastic materials without rate effects, and the theory is illustrated by examples. Author (TAB)

N70-16731 New York Univ., N.Y. School of Engineering and Science.
KEAM RESPONSE TO ACCELERATED MOVING FORCING FUNCTIONS
Joseph F. Thelsen, Jr. (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-4581

A numerical procedure is introduced for the solution of three problems involving the response of simply supported and continuous girder spans to multiple uncoupled forcing functions accelerating across the length of the beam. The problems examined are the simply supported elastic beam, the simply supported beam in the elastic-plastic range, and the elastic continuous beam. An approximate method of analysis is used in each instance in which the actual beam is replaced by a series of lumped rigid masses connected by inextensible bars with moment springs at each mass point. Since angle changes are assumed to occur only at the mass points, the deflection curve of the substitute structure consists of straight line segments. Numerical results are obtained with the aid of a large-scale digitalcomputer. Dissert. Abstr.

N70-16760 Colorado Univ., Denver.
AXISYMMETRIC PROBLEMS OF ELASTICITY
Giridhari Lal Agrawal (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-4357

Navier's equations for the axisymmetric case are integrated using Hankel transforms of mixed order. The resulting differential equations, for the elastostatic case, are solved in a completely general form. The boundary conditions are transformed on the Hankel transform plane, by which constants of integration can be evaluated directly. Using the theory, exact solutions of following four boundary value problems are obtained. An arbitrarily prescribed axial body force acts along the axis of a half space. An arbitrarily prescribed body moment acts along the axis of a half space. An axial load acts at the center of a thick finite circular plate which has zero displacement field along the cylindrical boundary. The dynamic solution of a finite circular cylinder with built-in cylindrical surface and traction free ends is obtained when an arbitrarily prescribed body moment acts along its axis. Dissert. Abstr.

N70-16766 Cincinnati Univ., Ohio.
VIBRATION ANALYSIS OF PRESSURIZED FLUID-ELASTIC STRUCTURES INCLUDING ACOUSTIC EFFECTS
Gerard Gregory Ventre (Ph.D. Thesis) 1968 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-6357

The free vibration of a continuous elastic structure partially filled with an incompressible liquid and partially with a compressible gas was investigated. Two elastic cylindrical shells, having a common axis but having different diameters, are connected by a circular elastic plate. The entire structure is pin-supported at the top circumference of the larger cylinder, which is called the tank. The bottom of the smaller cylinder, or pipe, is a rigid circular plate. The liquid completely fills the pipe and partially fills the tank. The remaining volume in the tank is occupied by the compressible gas. The types of vibratory motion which have been considered are: the longitudinal extension and contraction of the cylinders, the axisymmetric radial breathing of the cylinders, the nonaxisymmetric radial and circumferential breathing of the tank, the bending of the plate, the sloshing of the liquid, and the acoustical motion of the gas. Dissert. Abstr.

N70-16788# IIT Research Inst., Chicago, Ill. Mechanics and Materials Research Div.
FEASIBILITY OF JOINING ADVANCED COMPOSITE

FLIGHT VEHICLE STRUCTURES Final Report, 1 May 1966–1 Jul. 1967
D. Kutscha and K. E. Hofer Jan. 1969 494 p refs
(Contract AF 33(615)-3962)
(AD-690616; AFML-TR-68-391) Avail: CFSTI CSCL 11/4

A combined analytical-experimental study was carried out to establish the feasibility of developing rational design techniques for bonded and mechanical joints in advanced composite structures, available stress analyses were compared for their predictions of maximum stresses in joints and these results were compared to experimental data. The static strengths were measured for three adhesives bonded to fiberglass, steel, and titanium, and the fatigue strengths were measured for the optimum joint designs. The load distribution and joint strength was studied for fiberglass bolted joints. Recommendations were made for specific additional work required both in joints analysis and characterization of materials.
Author (TAB)

N70-16807 Pennsylvania State Univ., University Park.
HARMONIC WAVES IN A COSSERAT CONTINUUM
Ralph Hilmar Koebke (Ph.D. Thesis) 1968 165 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-5565

The equations of a Cosserat continuum are developed for the case of isotropic, centrosymmetric materials, and the solutions of three problems of elasto-dynamics are presented. First, the problem of plane harmonic waves in infinite media is investigated. It is shown that dispersion of waves occurs whenever a transverse motion is present. Furthermore, nonclassical wave modes having finite cut-off frequencies may exist in addition to the counterparts of the classical longitudinal and transverse waves. Secondly, the problem of a surface wave at a free boundary of a semi-infinite medium is solved. This surface wave is analogous to the Rayleigh wave of classical theory except that it is a dispersive wave. Lastly, an attempt is made to find a counterpart to the Lame modé of vibration of a plate in the context of Cosserat theory. A vibration mode similar to the classical Lamé mode may exist for certain ratios of material parameters. Dissert. Abstr.

N70-16809 Colorado Univ., Boulder.
RESPONSE OF RECTANGULAR STIFFENED PLATES SUBJECTED TO A MOVING SPRING MASS LOAD
Ganpat Mal Singhvi (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-4348

An analytical procedure to predict the behavior of orthogonally stiffened plates subjected to a moving sprung mass system was developed. The loading considered consists of a damped spring-borne mass supported by an unsprung wheel mass subjected to a pulsating driving force moving with a constant velocity in an arbitrary straight path across the plate. The Huber equation, modified to consider geometric anisotopy of the plate, and D'Alembert's principel were used to formulate the governing coupled differential equations of motion. A general solution for the governing differential equations is obtained as functions of space and time coordinates and certain undertermined coefficients. By means of known matching relationships, a recurrence formula is derived from which an infinite system of linear algebraic equations is obtained for an infinite set of undertermined coefficients. Numerical solutions in which dynamic deflections and dynamic bending moments at the center of the plate and under the load are calculated for a rectangular stiffened plate are compared with moving constant force and crawl load solutions. Dissert. Abstr.

N70-16813 Michigan State Univ., East Lansing.
STRESS ANALYSIS OF THE ADHESIVE SCARF JOINT BETWEEN DISSIMILAR ADHERENDS
Pethinaidu Surulinarayanasami (Ph.D. Thesis) 1968 224 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 69-5967

This study determines the adhesive stress distribution in scarf joints between elastically dissimilar adherends. Results are presented for five scarf angles; four levels of adherend dissimilarity; three levels of adhesive flexibility in the range appropriate for the bonding of metals and plastics; and for both tensile and bending loading of the joint. The adherends are treated using plane stress, and the adhesive is capable of resisting shear, and normal stress perpendicular to its plane, with strains assumed to be uniform through its (small) thickness. Only linearly elastic behavior is considered. The Rayleigh-Ritz method is employed to obtain the extensive stress tables presented. Systems of 177 linear equations are solved. This corresponds to the representation of each of the four components of displacement (two elastic bodies) by the sum of all homogeneous polynomials in x and y through the eighth degree. The convergence of the solutions is examined, and the adhesive stress distributions are discussed exhaustively.
Dissert. Abstr.

N70-16829 Oregon State Univ., Corvallis.
THERMO-ELASTIC-PLASTIC TRANSITION
Bolindra Nath Borah (Ph.D. Thesis) 1969 165 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-5286

The transition points are identified from the differential system which characterizes the physical phenomenon. How and in what manner the transition is to be understood is examined. Once one recognizes the transition zone as a separate state, the natural question of determining the constitutive equation also arises. Four problems of practical interest are discussed in detail. The problems of elastic-plastic transition of shells and tubes subjected to external pressure are solved. By considering the effect of a steady state temperature, the problems of thermo-elastic-plastic transition of shells and tubes are also solved. No yield conditions have been assumed. It is found that if they exist, they come out of the differential system as a consequence of the transition analysis. Some of the results have been compared with those of the classical theory. Dissert. Abstr.

N70-16841# Iowa State Univ. of Science and Technology Ames.
THE EFFECT OF STRESS ON THE LOW-TEMPERATURE OXIDATION OF NIOBIUM
Lawrence John Weirick (Ph.D. Thesis) May 1969 240 p refs
(Contract W-7405-eng-82) (IS-T-304) Avail: CFSTI

A lateral compressive stress of about 94,000 psi was found to exist in a thin film of niobium pentoxide which had formed on niobium oxidized near 425 C in oxygen at atmospheric pressure for up to three hours. This compressive stress agreed very well with a known value of room-temperature compressive strength of niobium pentoxide of 117,000 psi. A compressive stress in an effective thin film of NbO was found to be about 125, 150, or 171 thousand psi if the thin film was composed of Nb_6O, Nb_5O, or Nb_4O, respectively. The resulting tensile stress on the substrate surface due to the oxidation process was found to be small, around 10,000 psi. It was found that the formation of niobium in the temperature range of 425 to 440 C, was a function of initial specimen oxygen concentration, oxidation temperature, and applied tensile stress. It was further found that when the oxygen concentration at the substrate surface has reached an equilibrium level and the suboxide plates had formed, only a small tensile stress was needed to form microcracks in a surface of the metal associated with these suboxide needles. Author (NSA)

N70-16904 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF KEYWAYS, TRANSVERSE HOLES AND CIRCUMFERENTIAL GROOVES ON THE FATIGUE STRENGTH OF SG IRON COMPONENTS
L. V. Danilov 21 Jul. 1969 9 p refs Transl. into ENGLISH from Izv. Vysshka. Uchebn. Zavedenii, Mashinostr. USSR (Moscow), no. 2, 1961 p 107–110 In RUSSIAN and ENGLISH
(NLL-Trans-746/98-(9022.401)) Avail: Natl. Lending Library.

Boston Spa, Engl.: .1 NLL photocopy coupons.

An experimental investigation was carried out into the fatigue strength in symmetrical bending of S.G. iron specimens with various notches. Calculation of the strength of machine components is based on the introduction of an effective coefficient of stress concentration. This magnitude was evaluated for cylindrical specimens provided with various keyways, transverse holes, and circumferential grooves. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-15528# Boeing Scientific Research Labs., Seattle, Wash.
ON THE CONNECTION BETWEEN THERMAL CONDUCTIVITY AND DISLOCATION MOBILITY AT LOW TEMPERATURES
Peter Gruner Aug. 1969 29 p refs
(AD-695500: D1-82-0901) Avail: CFSTI CSCL 20/12

The low temperature dragging force on moving dislocations on account of phonon scattering is calculated with the help of phonon relaxation times which are available from the theory of thermal conductivity. It is assumed that the dislocations move uniformly with a velocity that is much smaller than sound velocity. Numerical values for the friction coefficient are obtained for straight edge and screw dislocations with the material constants of copper. The results are compared with the corresponding data for the case of moving kinks. Author (TAB)

N70-15549# ARO, Inc., Arnold Air Force Station, Tenn.
DETERMINATION OF THE EXCITATION REACTION OF THE OH RADICAL IN H2-O2 COMBUSTION
M. G. Davis, W. K. Mc Gregor, Jr., and A. A. Mason (Tenn. Univ. Space Inst.) AEDC Oct. 1969 88 p refs
(Contract F40600-69-C-0001)
(AD-695471; AEDC-TR-69-95) Avail: CFSTI CSCL 20/9

In this study, a method has been outlined for investigating extrathermal radiation from flames. In the case of chemiluminescence, a method of approach for isolating the chemical reactions responsible was shown. A method for calculating the excitation reaction rate of such a reaction was developed. An indirect result of this study was the conclusion that the concept of partial equilibrium is valid for lean H2-O2 flames downstream of the reaction zone. This supports the belief of many investigators in reaction kinetics. Author (TAB)

N70-15556# Boeing Co., Seattle, Wash. Mathematics Research Lab.
SPOT HEATING OF PLATES
F. Edward Ehlers Sep. 1969 35 p refs *Its* Mathematical Note No. 619
(AD-695496; D1-82-0903) Avail: CFSTI CSCL 20/13

The heat equation was solved for the temperature distribution in an infinite plate with one surface insulated and with heat applied locally to the other surface. Two classes of boundary conditions on the heated surface were considered: (1) A circle or a strip is heated at a rate to maintain it at a constant elevated temperature. (2) Heat is applied at a constant uniform rate to a circle or strip on one surface of the plate. Author (TAB)

N70-15597# National Bureau of Standards, Washington, D.C. Building Research Div.
RADIATION ERRORS IN AIR DUCTS UNDER NONISOTHERMAL CONDITIONS USING THERMOCOUPLES, THERMISTORS, AND A RESISTANCE THERMOMETER
Joseph C. Davis Nov. 1969 17 p refs *Its* Building Science Series 28
Avail: SOD $0.25 (No CFSTI pricing)

Radiation error in temperature measurements made with thermocouples, thermistors, and a resistance thermometer in moving air at velocities ranging from 300 to 1300 fpm when the temperature of the duct wall surrounding the air stream was from 0 to 50 deg F higher than that of the air in the center of the duct was determined. To eliminate all but the variable, conduction errors were minimized to a point where they were almost nonexistent by using Chromel P-constantan thermocouple wire and by employing other techniques. Radiation effects were studied when the probe housing the three types of temperature sensors was unshielded and again when it was shielded. Sensors were unshielded and the temperature difference between the duct wall and the air was 50 deg F (28 K, approximately); the error in the sensors was about 3.8 deg F (2.1 K) for an air velocity of 300 fpm (1.5 m/s) and 1.0 deg F (0.6 K) for an air velocity of 1300 fpm (6.6 m/s). When the sensors were shielded, the error was about 0.2 deg F (0.1 K) for 300 and 500 fpm velocities. Tests were not performed at 1300 fpm with the sensors shielded because theory indicated that radiation error would be negligible at this velocity. Author

N70-15603# Bureau of Mines, Pittsburgh, Pa. Safety Research Center.
RESEARCH AND TECHNOLOGIC WORK ON EXPLOSIVES, EXPLOSIONS, AND FLAMES
Jan. 1970 38 p refs
(BM-IC-8442) Avail: Issuing Activity

The principal activities of the Bureau of Mines Explosives Research Center during fiscal year 1968 are reviewed. Short abstracts of the publications issued during this period are presented. A study on the thermal decomposition of RDX and HMX is discussed. Author

N70-15653*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SHOCK-TUBE THERMOCHEMISTRY TABLES FOR HIGH-TEMPERATURE GASES, 90% CARBON DIOXIDE AND 10% NITROGEN, VOLUME 2
W. A. Menaro and T. E. Horton 1 Dec. 1969 88 p refs
(Contract NAS7-100)
(NASA-CR-107655; JPL-TR-32-1408-Vol-2) Avail: CFSTI CSCL 20M

Equilibrium thermodynamic properties and species concentrations for a mixture of 90% CO2 and 10% N2 are tabulated for moving, standing, and reflected shock waves. Initial pressures range from 0.05 to 50.0 torr, and temperatures from 1000 to over 100,000 K. In this study, 34 molecular and atomic species are considered. Author

N70-15764*# Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
OPTIMAL WALL TEMPERATURE CONTROL OF A HEAT EXCHANGER
Harng-sen Huang, L. T. Fan, and C. L. Hwang 25 Jun. 1969 42 p refs
(Grant NGR-17-001-034; Contract F44620-68-C-0020)
(NASA-CR-107697; AD-688420; AFOSR-69-1573TR; Rept-15) Avail: CFSTI CSCL 13A

An optimal wall temperature control of a single-duct heat exchanger is studied. The wall temperature which is the control variable is assumed to be uniform in space but a function of time. The system considered is a distributed parameter system where the fluid temperature is a function of time and a spatial coordinate. The control is to force optimally the temperature profile of the fluid from the initial state to a new desired steady temperature profile in a finite time. Two different performance indexes are considered. One is the integral of the absolute deviation of the system

temperature profile at any moment from the new desired steady state profile. Both are to be minimized. Optimal solutions are obtained by two methods, namely, linear programming and a variational technique. Author (TAB)

N70-15818# Kyushu Univ., Fukuoka (Japan).
EXPERIMENTAL INVESTIGATION ON THE MECHANISM OF TRANSITION BOILING HEAT TRANSFER
Kaneyasu Nishikawa, Tetsu Fujii, and Hiroshi Honda *In its* The Rept. of Res. Inst. of Ind. Sci., Kyushu Univ., No. 48 1969 p 6–17 refs In JAPANESE; ENGLISH summary (See N70-15816 05-34)
Avail: CFSTI

Experiments of saturated pool boiling were conducted on a horizontal copper surface of 8 mm diameter using distilled water as test liquid. Behavior of bubbles and fluctuation of surface temperature were examined for both regions of nucleate and transition boiling with the following results. (1) In both regions of nucleate and transition boiling, behavior of vapor mushroom is the same. (2) In transition boiling region the void fraction of liquid space next to the boiling surface has a constant value of about 0.95, and (3) It has been quantitatively verified that liquid-solid contact is a factor controlling transition boiling heat transfer. Author

N70-15819# Kyushu Univ., Fukuoka (Japan).
ON THE STABILITY OF TRANSITION BOILING
Hiroshi Honda and Kaneyasu Nishikawa *In its* The Rept. of Res. Inst. of Ind. Sci., Kyushu Univ., No. 48 1969 p 18–24 refs In JAPANESE; ENGLISH summary (See N70-15816 05-34)
Avail: CFSTI

In transition boiling region the boiling characteristic curve shows a unique nature to drop its heat flux with increase of wall temperature, which renders transition boiling unstable. Static and dynamic stability criteria for a pool boiling system in which hot water or condensing vapor is used as heat source are derived. The criteria were tested for three boiling systems, the results of which were proved to be valid. Author

N70-15855# Thermo Electron Corp., Waltham, Mass.
RESEARCH AND DEVELOPMENT OF VACUUM FOIL-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS Quarterly Progress Report, Mar. – May 1969
J. Carvalho, J. B. Dunlay, M. L. Paguin, and V. L. Poirier 28 Jul. 1969 27 p
(Contract AT(30-1)-3634)
(ALO-3634-13) Avail: CFSTI

Continuing work on the development of high temperature thermal insulation is reported. Under uniform compressive stresses of 2.1 and 5.2 psi, insulation samples fabricated using 5 to 10 micron ZrO sub 2 particles transmitted lower heat fluxes than similar samples fabricated using 15 to 25 micron ZrO2 particles. Under certain conditions, up a 40% difference was observed. The final five insulation samples fabricated for the reproducibility studies have been evaluated in the planar heat transfer test apparatus. The same samples were combined to produce a final set of layer variation data. The low temperature heat transfer tests have been completed. Heat flux and thermal conductivity data are presented for 40 and 80 layers of SS–ZrO2 insulation and 40 layers of Ti–ZrO2 insulation. An unidentified material condensed in the pyrometer holes, making temperature measurements difficult. Author (NSA)

N70-15902# Southwest Research Inst., San Antonio, Tex. Dept. of Mechanical Sciences.
DEVELOPMENT OF CAPABILITIES OF A LIGHT-INITIATED, SPRAYED EXPLOSIVE
W. E. Baker, F. O. Hoese, and S. Silverman Sep. 1969 38 p refs
Avail: CFSTI

The feasibility of a number of new applications of a light initiated, sprayed primary explosive were determined. A number of improvements were made in an impulsive loading technique developed under previous internal research projects. Author

N70-16035 National Lending Library for Science and Technology, Boston Spa (England).
THE THERMAL CONDUCTIVITY OF HELIUM-HYDROGEN MIXTURES
I. F. Golubev et al 2 Jul. 1969 6 p ref Transl. into ENGLISH from Gaz. Prom. (Moscow), v. 11, no. 11, 1966 p 48–50
(NLL-MINTECH-T-6035-(5809.950)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Experimental data are given for the dependence of the thermal conductivity on temperature, pressure and composition for three helium-hydrogen mixtures at temperatures from 77.96 to 373.16 deg K and pressures up to 50 mN/m2. The data were obtained by a routine method in a coaxial cylinder apparatus. Author

N70-16061# Naval Undersea Research and Development Center, San Diego, Calif.
ELECTROMAGNETIC RADIATION AND HEAT CONDUCTION FIELDS NEAR COAXIAL CONICAL STRUCTURES Research Report, Sep. 1968–Apr. 1969
W. A. Middleton Aug. 1969 53 p refs
(AD-694012; NUC-TP-159) Avail: CFSTI CSCL 20/14

The effect of a time harmonic electric source ring placed axially symmetric between the walls of a double conical structure of finite slant height is investigated. The bases of the conical structures are spherical caps of radii equal to the slant height. The Greens function for ideally conducting walls is obtained using the normalized eigenfunction expansion theorem. The magnetic and electric components of the induced electromagnetic field are obtained in the form of a single infinite series. The solution is investigated for several special cases, including the finite single cone, semi-finite single cone, semi-infinite double cone, and biconical antenna. The heat conduction problem for the identical geometry is also solved. The solution is obtained by employing the theory of Laplace transformations on the Greens functions for the electric source ring. Two cases, finite and semi-infinite slant heights, present two forms of solutions. Finite slant height yields a double infinite series and semi-infinite slant height a single infinite series. Author (TAB)

N70-16139*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FORCED CONVECTION BOILING NEAR INCEPTION IN ZERO-GRAVITY
Thomas H. Cochran Washington Jan. 1970 25 p refs
(NASA-TN-D-5612; E-5148) Avail: CFSTI CSCL 20M

An experimental program was conducted to study the behavior of forced-convection boiling at low heat flux and low flow velocities in zero gravity for slightly subcooled distilled water. The results indicated the existence of a bubble boundary layer on the heated surface. A correlation for the size of the bubbles was obtained and found to be a function of the saturation layer thickness. Author

N70-16151# General Electric Co., Schenectady, N.Y.
HEAT TRANSFER AND HYDRAULICS: THE EFFECTS OF SUBCOOLED VOIDS Final Report, Feb. 1967–Jun. 1969
F. W. Staub and G. E. Walmet May 1969 253 p refs Sponsored in part by EURATOM
(Contract AT(30-1)-3679)
(NYO-3679-8; EURAEC-2120) Avail: CFSTI

An experimental and analytical program directed toward the determination of the void distribution, location of the initiation of net vapor generation pressure drop, and heat transfer coefficients in subcooled boiling water systems is described. Analytical formulations for the prediction of the subcooled flow boiling void fractions and pressure drop are presented. The void profile, pressure drop, and heat transfer measurements were extended to a reduced

pressure range of 0.3 to 0.7, and the higher quality regions, using the Refrigerant-22 facility. All water experiments were conducted with and without a reactivity and a pH control additive to determine their effect at both low and high pressures. General equations were derived which accurately predicted the void fraction, pressure drop, and heat transfer coefficients in two-phase flow with subcooled boiling for various fluids and over a wide range of operating conditions. NSA

N70-16196# Liverpool Univ. (England). Dept. of Mechanical Engineering.

HEAT TRANSFER IN A TUBE REVOLVING ABOUT A DISPLACED AXIS

J. F. Humphreys London HMSO 1969 15 p refs Supersedes ARC-30561; (N69-19757)

(ARC-CP-1069; ARC-30561) Copyright. Avail: HMSO 4s; BIS $0.60; CFSTI

Consideration is given to heat transfer and fluid flow in the entry region of a tube revolving about a displaced axis parallel to the tube axis. Experimental results indicate that both inherent swirling flow and centrifugal buoyancy contribute to increases in heat transfer as a result of rotation. Author (ESRO)

N70-16421# Naval Ordnance Lab., White Oak, Md. Chemistry Research Dept.

EXPLOSIVE BEHAVIOR OF DINITROTOLUENE

D. Price, J. O. Erkman, A. R. Clairmont, Jr., and D. J. Edwards 10 Jul. 1969 43 p refs

(AD-694944; NOLTR-69-92) Avail: CFSTI CSCL 19/1

DNT shows Group 1 explosive behavior although it can be dead pressed moderately easily. Its infinite diameter detonation velocity is approximated by an equation. Its detonability and shock sensitivity are, respectively, near those of high bulk density nitroguanidine and DATB. A review of factors affecting detonability and sensitivity of a chemically homogeneous explosive is also presented. Author

N70-16487*# Rocketdyne, Canoga Park, Calif.

ANALYSIS OF THE ACOUSTIC BEHAVIOR OF BAFFLED COMBUSTION CHAMBERS

C. L. Oberg, T. L. Wong, and R. A. Schmeltzer Jan. 1970 83 p refs

(Contract NAS3-11226)

(NASA-CR-72625; R-8076) Avail: CFSTI CSCL 21B

As a means of studying the effects of baffles on acoustic modes of combustion instability, analytical methods have been developed for calculating the wave motion in closed, baffled chambers with rigid or nonrigid boundaries. These methods encompass solving the wave equation for the baffled chamber by converting the differential equation and boundary conditions to an integral equation which, in turn, is solved by approximate means. A variational technique in combination with an iterated approximation was used to solve the integral equation. Numerical results were obtained for two-dimensional chambers containing one or several equal length and equally spaced baffles. The results show an essentially continuous pressure distribution along the baffle tips. Author

N70-16492# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

ON A THEORY OF GENERAL RELATIVISTIC THERMODYNAMICS AND VISCOUS FLUIDS

A. Cemal Eringen Mar. 1969 40 p refs Presented at Intern. Symp. on a Critical Rev. of the Fund. of Relativistic and Classical Thermodyn., Pittsburgh, 7-8 Apr. 1969

(Contract N00014-67-A-0151-0004)

(AD-695384; TR-8) Avail: CFSTI CSCL 20/13

The present work is concerned with relativistic continuum mechanics, within the framework of the general theory of relativity. Basic balance laws and the thermodynamics of the general continua are introduced. Constitutive equations for nonlinear and linear thermoviscous fluids are obtained and restricted by use of the second law of thermodynamics. Author (TAB)

N70-16520# Los Alamos Scientific Lab., N.Mex.

TEMPERATURE CONTROL FOR MAINTAINING RESONANCE OF LINAC TANKS

G. R. Swain, R. A. Gore, and R. A. Jameson *In* Brookhaven Natl. Lab. Proc. of the 1968 Proton Linear Accelerator Conf., Part 1 May 1968 p 159-167 *ref* Sponsored by AEC (See N70-16501 05-24)

Avail: CFSTI

Electrical controllers and actuators are being used while natural compatibility of an all fluidic system with temperature control was set aside because of difficulty in interfacing with other equipment. Analog controller circuitry is evaluated along with some slower control functions using digital systems. Drift tube linac tanks, four-foot drift tube linac model with full-size two-cell structure, and 201.25 MHz drift tube linac portion of LAMPF are reviewed. J.A.M.

N70-16584# Akademiya Nauk URSR, Kiev.

THERMOPHYSICS AND THERMOENGINEERING: MINING THERMOPHYSICS

V. I. Tolubinskij ed. 1968 124 p refs In RUSSIAN

Avail: CFSTI

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6. PRESSURE EFFECTS ON FILTRATION OF A HEAT CARRIER IN EARTH CORE ROCKS A. S. Teyrulnikov and A. I. Fialko p 31-35 refs (See N70-16589 05-13)

6. CALCULATIONS ON BOILER APPARATUS FOR EXPLOITING SUB-SURFACE HEAT SOURCES A. V. Shurchkov p 36-40 refs (See N70-16590 05-13)

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9. HEAT TRANSFER IN FLOW PROCESSES FROM DEEP BOREHOLES Yu. P. Dobryanskiy, E. I. Baratov, and B. P. Chernyak p 59-65 refs (See N70-16593 05-13)

10. CALCULATING THE EFFECT OF HEAT TRANSFER ON AIR DISTRIBUTION IN A MINING NETWORK B. I. Medvedev (Donets Politechnical Inst.) p 66-72 (See N70-16594 05-12)

11. CALCULATING THE INDEX OF ENDOGENIC INFLAMMABILITY ON THE BASIS OF HEAT TRANSFER AND THERMOCHEMICAL PROCESSES Kh. A. Bayev p 73-78 refs (See N70-16595 05-33)

12. CALCULATING EXPENDITURES FOR COOLING THE AIR IN A MINE SHAFT D. A. Karpov p 79-84 refs (See N70-16596 05-14)

13. THERMOGRADIENT MEASUREMENTS IN DEEP

BOREHOLES A. N. Shcherban and N. I. Furman p 85–92 refs (See N70-16597 05-14)

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15. IMPROVING THE PROCESS OF TREATING MERCURY ORES E. I. Baratov, E. N. Maleshenko, and A. N. Shcherban p 101–108 refs (See N70-16599 05-17)

16. THE HEAT OF METHANE SORPTION BY COAL I. A. Ryzhenko p 109–114 refs (See N70-16600 05-33)

N70-16585# Akademiya Nauk URSR, Kiev.
PRACTICAL APPLICATION OF UNDERGROUND HEAT SOURCES
V. Ya. Zhuravlenko, A. V. Shurchkov, and E. R. Grosman *In its* Mining Thermophysics 1968 p 7–14 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

Engineering and economic indicators are reviewed on the use of subsurface thermal waters in heat supply and power generating systems. An artifical circulation system is proposed for heat transfer from subsurface porous layers using 'underground boilers.' Preliminary calculations for this system are given. E.C.

N70-16586# Akademiya Nauk URSR, Kiev.
CALCULATING THE INDEX OF ENDOGENIC INFLAMMABILITY ON THE BASIS OF HEAT TRANSFER AND THERMOCHEMICAL PROCESSES
Kh. A. Bayev *In its* Mining Thermophysics 1968 p 73–78 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

The inflammability of coal deposits can be calculated for warning of endogenic fires in coal mines. Fire hazards are usually evaluated by the tendency of coal to spontaneous combustion (chemical activity), which is related to the capacity of coal for oxidation and heat liberation. However, this evaluation often does not correspond to the actual fire hazard, because spontaneous combustion is a very complex process in which other factors, such as the size of the coal seam, air flow, conditions of heat transfer to the surrounding medium, etc., play a significant role in addition to chemical activity. Under certain conditions a combination of several factors causes spontaneous combustion of coal even with little chemical activity. Differential equations are derived for calculating some of these facotrs, and the heat transfer and thermochemical processes of spontaneous combustion of coal are considered. Transl. by R.B.

N70-16589# Akademiya Nauk URSR, Kiev.
CALCULATING EXPENDITURES FOR COOLING THE AIR IN A MINE SHAFT
D. A. Karpov *In its* Mining Thermophysics 1968 p 79–84 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

Exploitation of coal deposits in deep-lying seams requires continuous reduction of the heat content of air in the shaft to safe limits, i. e. excess heat must be removed artificially to create normal climatic conditions in the working areas. Seasonal fluctuations of air temperature at the surface, the movement of face lines, and the complex heat and mass transfer processes which take place in mines determine the microclimate of the shaft. Formulas are derived for calculating required expenditures for cooling mine shafts and cost factors are established on the basis of experimental data for maintaining required temperature in the shafts. Transl. by R.B.

N70-16600# Akademiya Nauk URSR, Kiev.
THE HEAT OF METHANE SORPTION BY COAL
I. A. Ryzhenko *In its* Mining Thermophysics 1968 p 109–114 refs In RUSSIAN (See N70-16584 05-33)
Avail: CFSTI

Investigations of the heat of methane soration by coal in different stages of metamorphism show that the Clapeyron equation may be used in equilibrium systems for calculating the temperature effects which accompany the transition from one phase to another. The given equation was derived for conditions when the gaseous phase is subject to the equation of state of ideal gases, and the differential heart of sorption is not dependant on the pressure of the gas and the temperature of the system. Transl. by R.B.

N70-16682*# Mathematical Applications Group, Inc., White Plains, N.Y.
ANALYTICAL STUDY OF CONTROL DEVICES FOR HIGH AMPLITUDE COMBUSTION INSTABILITY Quarterly Report
Samuel Z. Burstein and Harold Schechter 15 Oct. 1969 65 p
(Contract NAS7-752)
(NASA-CR-107751; QR-1) Avail: CFSTI CSCL 20B

Results of computer experiments being carried out on a numerical model of combustion processes in an annular rocket motor are described. The combustion process is controlled by an evaporation rate controlling mechanism but can be modified so as to include kinetic type energy release models. The model simulates numerically the complete nonlinear gas dynamic flow field in an annular motor. The coordinates are the axial length, the angular coordinate, and time. This model is two-dimensional and time dependent, and includes the interaction of the combustion process with the nonlinear gas dynamic flow field. Author

N70-16703 Louisiana State Univ., New Orleans.
IRREVERSIBLE THERMODYNAMICS AND TRANSPORT PROCESS IN A SOLID WITH DEVICE APPLICATIONS
George T. Craig (Ph.D. Thesis) 1968 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-4460

Solids having the simultaneous interaction of electrical and thermal fields in the presence of external magnetic fields represent systems which cannot be solved thermodynamically from the classical viewpoint. The concepts of irreversible thermodynamics are used to obtain, in general vectorial form, the equations governing the flow of heat currents and electrical currents in the solid. Adiabatic and isothermal coefficients of the thermomagnetic and galvanomagnetic effects are used in the analysis and comparisons made of the results. The general results are applied to two magnetothermonal electric energy conversion devices: the thermomagnetic generator and a thermomagnetic cooler. For the generator, information is obtained on power output and system efficiency. The magnitude of the coefficient of performance for the cooler is also obtained. Both devices are analyzed under adiabatic and isothermal effects with variable electrical conductivity. Dissert. Abstr.

N70-16710*# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
AN EXPERIMENTAL AND THEORETICAL STUDY OF RADIATIVE AND CONDUCTIVE HEAT TRANSFER IN NONGRAY SEMITRANSPARENT MEDIA
N. Dennis Eryou and Leon R. Glicksman Oct. 1969 170 p refs
(Grant NGL-22-009-019; DSR Proj. 76194)
(NASA-CR-107737; DSR-76194-66) Avail: CFSTI CSCL 20M

One dimensional temperature profiles and heat fluxes within a slab of molten glass were measured experimentally. The glass slab was contained in a platinum foil lined ceramic tray inside a high temperature furnace. An optical method of temperature measurement was developed in which a helium neon laser beam is directed along so isothermal path through the glass. The attenuation of the beam was a strong function of temperature and was used to evaluate the local temperatures within the glass slab. In order to perform a theoretical analysis the spectral absorption coefficient of the glass was measured between .6328 microns and 2.75 microns from 2000 to 2300 F. Two analyses were performed, one for a diffuse platinum glass boundary and the other for a

specular boundary. The experimentally measured temperature profiles and heat fluxes agreed with the predicted profiles within 5 F and the heat fluxes to within ten percent. Author

N70-16718*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
APPENDIX 3: HEAT TRANSFER FROM CYLINDRICAL SURFACES TO LIQUID HELIUM I
Kenneth R. Efferson *In its* Magnetic Flux Flow and Superconductor Stabilization Nov. 1968 p 66–89 refs Presented at the Appl. Superconductivity Conf., Gatlinburg, Tenn., 1968 (See N70-16713 05-26)
Avail: CFSTI CSCL 20M

Heat transfer from a cylindrical copper surface to liquid helium at 4 K has been measured. The sample consisted of a horizontally mounted 3 outer diameter, evacuated glass tube 6.5 cm long, onto which was deposited a 2000 A thick copper film. It was heated by passing an electrical current through the copper film, and the temperature was monitored by a carbon resistor attached to the inside of the glass tube with varnish. In initial experiments, large temperature fluctuations were observed in the nucleate boiling region. These temperature fluctuations disappeared when the sample was either close to the liquid helium surface or when vertical walls were placed around the sample. The large temperature fluctuations were probably due to interactions of the convective flow of liquid helium with the boundaries of the system (dewar walls, liquid surface, etc.). Similar temperature fluctuation were observed with a stainless steel sample of approximately the same dimensions. The peak heat flux obtained in the nucleate boiling regime was 0.98 watts/sq cm vor Cu and 0.66 watts/ sq cm for stainless steel. Author

N70-16719# Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuigbouwkunde.
EVALUATION SUMMARY OF VARIOUS METHODS FOR COMPUTING HEAT CONDUCTION PROCESSES IN STEADY MEDIA
[OVERZICHT EN BEOORDELING VAN NUMERIEKE METHODEN VOOR HET BEREKENEN VAN WARMTEGELEIDINGSPROCESSEN IN VASTE LICHAMEN]
D. van Marer and T. Goemans Apr. 1969 27 p refs In DUTCH
(THD-KR-201; WTHD-15) Avail: CFSTI

This report gives a summary of the various non-iterative differentiation methods which can be used to calculate non-stationary temperature distribution in steady media. Example calculations are used to compare the methods with each other and final selection rests on the applicability to a special problem. Considered are one-dimensional and multidimensional problems.
Transl. by G.G.

N70-16831 Princeton Univ., N.J.
NEUTRON RADIOGRAPHIC EXAMINATION OF VAPOR BUBBLE FORMATION AS A LIMITATION ON PLANAR HEAT PIPE PERFORMANCE
Richard Alan Moss (Ph.D. Thesis) 1968 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-2769

An experimental study of the limiting heat transfer conditions in a planar heat pipe using water as a working fluid was conducted. The apparatus was designed to study the boiling processes that occur in the wick structure of a heat pipe. The vapor blanket which formed in the porous medium, i.e., the wick, during heat transfer was experimentally examined using neutron radiography. The neutron source for these experiments was the Industrial Reactor Laboratoires' 5 megawatt reactor. The neutron radiographic system was composed of the following basic elements: a beam tube, the object (a planar heat pipe), a neutron image intensifier tube, and image recording cameras. Using the image intensifier, it was possible to quantitatively measure the thickness of water present to + or – .006 inches for thicknesses up to .125 inches. The imaging system has a lateral resolution of .0135 inches. Dissert. Abstr.

N70-16888 National Lending Library for Science and Technology, Boston Spa (England).
IGNITION HAZARDS DURING THE USE OF HIGH PRESSURE OXYGEN [ZUENDGEFAHREN BEI VERWENDUNG VON HOCHGESPANNTEM SAUERSTOFF]
E. Schlebeck et al. 10 Sep. 1969 4 p Transl. into ENGLISH from ZIS Mitteilungen (German), v. 9, no. 10, Oct. 1967 p 1145–1446
(NLL-Trans-5785-(8313.4)) Avail: Natl. Lending library, Boston Spa, Engl.: 1 NLL photocopy coupon

The combustibility of materials in pure oxygen is briefly discussed, and a table is presented of oxygen-resistant materials suitable for use in oxyacetylene welding. D.L.G.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-16534# Naval Postgraduate School, Monterey, Calif.
A MODEL OF A SYSTEMS ANALYSIS STUDY
Carl R. Jones 10 Jul. 1969 41 p
(AD-695427; NPS-55Js9017A) Avail: CFSTI CSCL 5/1

The paper is concerned with a governmental decision-maker who chooses among alternatives whose costs and benefits have been illuminated analytically. The decision-maker is considered to be involved in a planning, programming and budgeting system and to be responsible for at least some area where cost-benefit studies can be helpful. The decision makers study team is envisaged as being given an assignment to develop the alternatives and their costs and benefits. The output of the study team is some representation of a cost-benefit surface. Author (TAB)

N70-15566*# Syracuse University, N.Y.
MULTIDISCIPLINARY STUDIES IN MANAGEMENT AND DEVELOPMENT PROGRAMS IN THE PUBLIC SECTOR Semiannual Report, 1 Jan.–30 Jun. 1969
Oct. 1969 34 p refs
(Grant NGL-33-022-090)
(NASA-CR-107656; SAR-3) Avail: CFSTI CSCL 05A

Four major interdisciplinary research projects, several smaller research activities, and an education and training program for graduate students are presently being conducted at Syracuse University as a result of the association between the University and the National Aeronautics and Space Administration. During this reporting period, members of the four major project teams and others made field trips to NASA Headquarters, NASA field centers, tracking stations both in the U.S. and abroad, universities and private corporations. Extensive research on the major and smaller projects was accomplished. Working papers and preliminary reports were written by faculty and graduate students and papers were delivered at several conferences. A graduate-level seminar on Science and Public Policy was offered and the University-wide NASA Seminar series continued with monthly meetings. Author

N70-15676*# North Carolina Science and Technology Research Center, Raleigh.
REGIONAL TECHNOLOGY TRANSFER PROGRAM Final Report, 1 Jun. 1968–31 Aug. 1969
31 Aug. 1969 118 p refs
(Contract NSR-34-007-006)
(NASA-CR-107625) Avail: CFSTI CSCL 05B

Three factors set the North Carolina Science and Technology Research Center apart from other Regional Dissemination Centers: its orientation with state government (rather than a university), the predominantly agrarian economy of the vast area it serves, and its

emphasis on the development of more sophisticated software for computerized information retrieval. Each of these factors has influenced the growth and effectiveness of the Center, and its impact, through the Technology Utilization Program, on industry in the Southeast. Through the graduate student program, the center has pioneered in providing low cost literature searches in technical and scientific fields to advanced degree candidates in 23 southern universities. This support strengthens the university's graduate program and funnels new technology into industry through the scientists and leaders of tomorrow. Several Science and Technology Research Center case histories are related to illustrate the effectiveness of a technology utilization program in this particular geographic area. Author

N70-15748# Advisory Group for Aerospace Research and Development, Paris (France).
THE AGARD HISTORY, 1952 - 1968
Frank L. Wattendorf, ed. Jul. 1969 149 p refs
Avail: CFSTI

Historical and background information on the founding and development of AGARD is given. Goals and activities since the inception of this NATO organization are mentioned. Proceedings of the annual meetings of the national delegate board, steering committee, and technical panels are reviewed, and the status of the consultant and exchange program and staff membership is assessed. J.M.C.

N70-15758# Air Force Logistics Command, Wright-Patterson AFB, Ohio.
THE RANGE MODEL
Jay F. Williams Aug. 1969 41 p refs
(AD-694075; OATM-8) Avail: CFSTI CSCL 15/5

The problem of initial support planning for new weapon systems is formulated as a three state parameter sequential decision process. A return function is defined in terms of the life cycle cost effects of the decision selected in each state. A technique is supplied for the treatment of fixed costs that avoids the problems involved in allocation and incremental costing. A step by step solution algorithm is described, providing a technique to obtain life cycle cost estimates, logistic resource requirements by echelon, and optimum repair procedures, from a basic engineering description of the hardware and knowledge of the cost and policy structure of the operating logistics system. Author (TAB)

N70-15788*+ Indiana Univ., Bloomington. Aerospace Research Applications Center.
URBAN TRANSPORTATION PLANNING ANNOTATED BIBLIOGRAPHY
Joseph Di Salvo and D. E. Lundgren [1968] 80 p refs
(Contract NSR-15-003-058)
(NASA-CR-107613) Avail: CFSTI CSCL 05B

Abstracts with descriptor terms of articles applicable to urban transportation planning are presented in indexed categories. The sources of these reports are: International Aerospace Abstracts, Scientific and Technical Aerospace Reports, and United States Government Research and Development Reports. F.O.S.

N70-15816# Kyushu Univ., Fukuoka (Japan).
THE REPORTS OF RESEARCH INSTITUTE OF INDUSTRIAL SCIENCE, KYUSHU UNIVERSITY, NO. 48
1969 40 p refs In JAPANESE; ENGLISH summary
Avail: CFSTI

CONTENTS:

1. MEASUREMENTS OF SPECIFIC HEATS OF LIQUIDS BY THE USE OF A THERMOS BOTTLE T. Fujii and I. Morioka p 1-5 refs (See N70-15817 05-14)

2. EXPERIMENTAL INVESTIGATION ON THE MECHANISM OF TRANSITION BOILING HEAT TRANSFER K. Nishikawa, T. Fujii, and H. Honda p 6-17 refs (See N70-15818 05-33)

3. ON THE STABILITY OF TRANSITION BOILING H. Honda and K. Nishikawa p 18-24 refs (See N70-15819 05-33)

4. DEVIATION OF STREAM SURFACE DUE TO BLADE THICKNESS DISTRIBUTION AT THE INDUCER OF MIXED FLOW COMPRESSORS Y. Senoo and N. Kunita p 25-31 (See N70-15820 05-12)

5. PRESSURE DISTRIBUTION AROUND A CYLINDER WITH JET AT THE REAR END Y. Senoo and M. Yamaguchi p 32-38 refs (See N70-15821 05-12)

N70-15882# Technische Hochschule Munchen (West Germany). Lehrstuel fuer Rauhfahrttechnik.
DETERMINATION OF A CONVERSION FACTOR TO TRANSLATE UNITED STATES SPACE PROJECT COSTS TO EUROPEAN CONDITIONS [ERMITTLUNG EINES FAKTORS MIT DESSEN HILFE AMERIKANISCHE RAUMFAHRTPROJEKTKOSTEN AUF EUROPAEISCHE VERHAELTNISSE UEBERTRAGEN WERDEN KOENNEN]
Heinz Gerst and Ulrich Galonska Apr. 1969 110 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Wiss.
(BMWF-FB-W-69-30) Avail: CFSTI

In order to take advantage of the experience gained in the USA on space cost estimates it is useful to transfer cost data on American projects to European conditions. An attempt was made to evaluate quantitatively the factors which determine the conversion rate and to obtain a special factor for spacecraft projects. An attempt was also made to find a statistical value for this conversion rate in a second independent way using American cost models and a cost model derived from the data of four European satellite projects. The main results are: (1) the main influences are productivity, labor-rates etc., (2) the conversion factor is highly time dependent, and (3) the value may vary in the range of 1.4 DM/$ to 4.5 DM/$. Author (ESRO)

N70-16392# European Space Research Organization, Paris (France).
ESRO/ELDO BULLETIN, NUMBER 7
Oct. 1969 33 p refs Partly in FRENCH and partly in ENGLISH Prepared jointly with ELDO
Avail: CFSTI

1. CONTRACT INCENTIVES AS A MANAGEMENT TOOL G. van Reeth (European Space Res. and Tech. Center, Noordwijk, Netherlands) p 4-8 (See N70-16393 05-34)

2. THE ELDO INERTIAL GUIDANCE SYSTEM A. Riley (CEC-Elliott Space and Weapon Sys. Ltd., Camberley, England) p 9-14 refs (See N70-16394 05-21)

3. PROGRESS IN OPERATIONAL PROGRAMME p 15-24 (See N70-16395 05-31)

N70-16393# European Space Research and Technology Center, Noordwijk (Netherlands).
CONTRACT INCENTIVES AS A MANAGEMENT TOOL [LE CONTRAT AVEC INTERESSEMENT COMME INSTRUMENT DE GESTION]
G. van Reeth *In* ESRO/ELDO Bull. No. 7 Oct. 1969 p 4-8 In FRENCH (See N70-16392 05-34)
Avail: CFSTI

This article describes the characteristics of contract management when an incentives policy is applied, referring to US experiences. The ESRO contract for HEOS-1 is used as an example of an European application of this policy. ESRO

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